JUL 17 1945

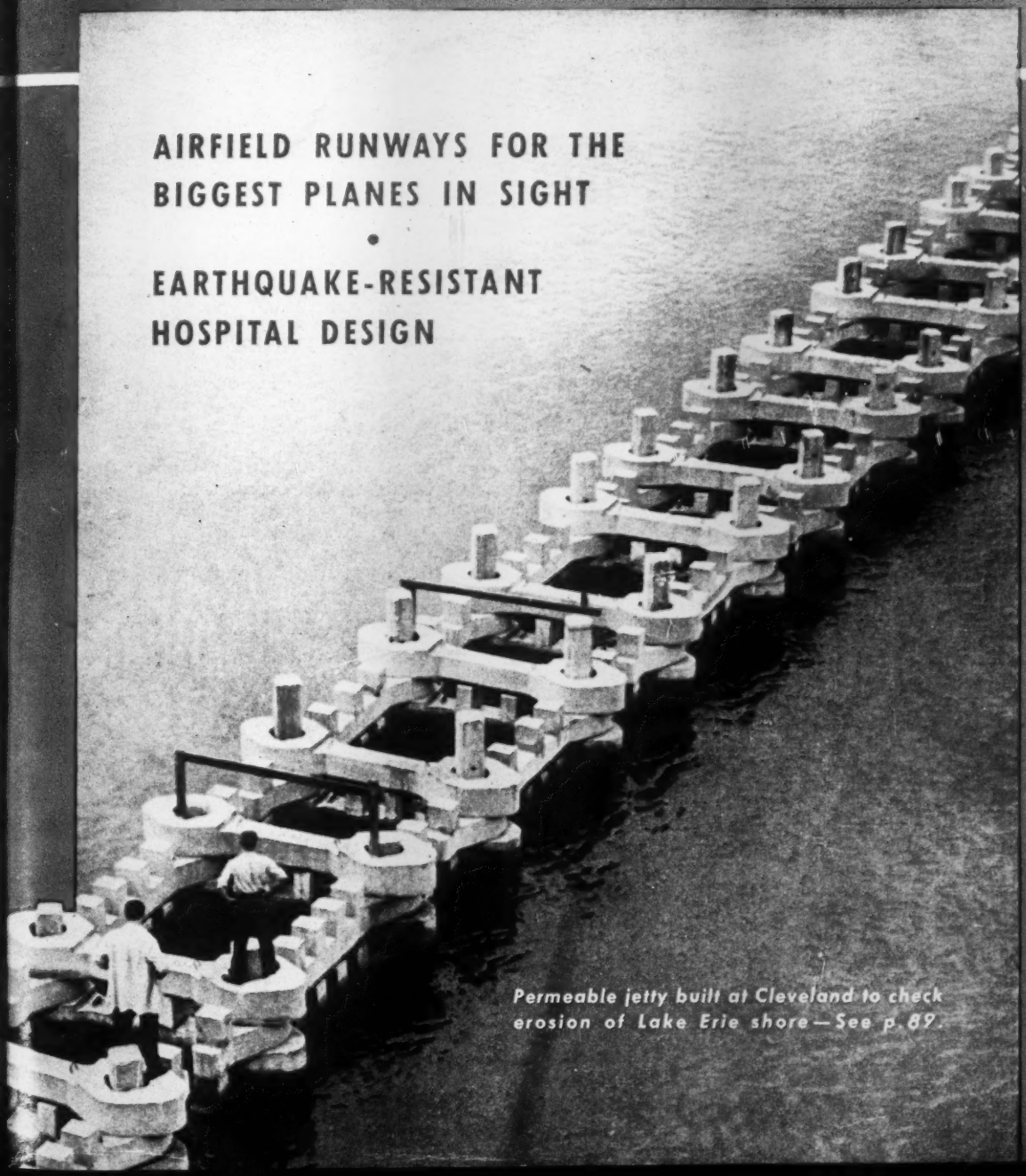
ENGINEERING NEWS-RECORD

JULY 12, 1945

AIRFIELD RUNWAYS FOR THE BIGGEST PLANES IN SIGHT

•

EARTHQUAKE-RESISTANT HOSPITAL DESIGN



Permeable jetty built at Cleveland to check erosion of Lake Erie shore—See p. 89.

Here's a **DREAM** *that's beginning to come true . . .*

BYERS SNOW MELTING *for airport runways*

This past winter gave an unusually vivid demonstration of the paralyzing effect of heavy snows on air travel, and re-emphasized the importance of "doing something about the weather." Byers Snow Melting, already completely proven on a smaller scale, is regarded by a number of hard-headed designers as the most promising solution.

The system, illustrated by the phantom drawing above, calls for the installation of grids of Byers Wrought Iron pipe under the runway surface. Steam or hot water is circulated through these grids, melting any snow or ice, and evaporating the water. This last point is highly important, as water on the runway may be as great a hazard as snow or ice.

At first glance the cost of such an installation might seem out of reach . . . but not when present costs for ineffective methods are considered. At one airport alone this past winter, the direct cost of snow removal plus annual write-off of equipment, was $200,000. Even with this expenditure, the runways were not kept clear, and in one four-day period 300 flights were cancelled, so that a heavy loss in revenue is added to the toll. Finally, there is the cost of possible accidents, where damage may run into the hundreds of thousands.

Right now, Byers Snow Melting installations are being figured for one large airport, and under consideration for several others. But its possibilities only begin there. It can keep driveways, walkways and platforms snow-free in industrial plants; one concern kept a 12 ft. x 80 ft. driveway clear all last winter with an installation. It can solve sidewalk snow removal for metropolitan buildings; and it can end the marooning of cars by icy or snow-covered driveways: (one user removed a half inch of ice in 20 minutes, 12-inches of snow in two hours.)

Naturally, an installation like this calls for pipe with unusual corrosion resistance, plus other special qualities. When steam is used, the condensate will always be aggressive . . . and the almost universal use of wrought iron for steam return lines demonstrates how well wrought iron resists this condition. Severe external corrosive attack should be anticipated . . . and hundreds of installations of Byers Wrought Iron pipe, buried in soil or embedded in concrete, certify to the durability of the material. Wrought iron expands and contracts at almost identical rates with concrete, which protects against thermal cracks. And the material has excellent heat emission, and can be easily formed and welded, facilitating installation.

If you would like to know more about Byers Snow Melting for airports, ask for the reprint, "Airport Snow Battle."

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE ALLOY STEELS · OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

ENGINEERING NEWS-RECORD

Devoted to Buildings, Sewers, Waterworks, Bridges, Roads, Dams, Foundations, Earthwork, Flood Control, Public Works, Shipbuilding, Irrigation, Canals, Railroads

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WALDO G. BOWMAN, *Editor* ALBERT E. PAXTON, *Publisher*

Vol. 135 JULY 12, 1945 No. 2

COMING NEXT

• One of the most important engineering equipment developments of the European war was that of the Bailey bridge. Its wide use for military highway bridging has been described many times in the pages of *ENR*. But what is not so well known is how these units were prefabricated in the United States to match exactly those duplicate units manufactured in Great Britain. Assembly line production methods used will be described in the July 26 issue.

• Not a minute was lost on account of 24 deg. below zero weather and snowfall aggregating some 90 in. during concrete construction work last winter on the MacArthur Lock at Sault Ste. Marie, Mich. The work involved construction of an 878-ft. long concrete facing wall, 39 ft. high and from 5 to 6½ ft. thick. This unusual accomplishment, which will be described in *ENR* July 26, is attributed to the meticulous care used in planning all phases of the work.

• An exceptional application of hydraulic dredging in constructing highway grade is solving a difficult problem of roadbuilding in North Carolina. The new work is planned to end a 20-year struggle to provide a stable road over a tidal marsh where an average of 30 ft. of root growth and muck covers the first layer of stable material. Construction procedure will be outlined in the July 26 issue.

LOOKING AHEAD

• How the use of coral helped turn the tide of battle against the Japs for repossession of Pacific islands is the subject of an article scheduled for an early issue. This hitherto little-known material has in reality turned out to be a surprisingly good construction material, even for concrete aggregate. There are many types of coral in the Pacific, and their characteristics and relative merits, as well as how each can be used to best advantage will be told.

• Enactment of uniform state building regulations to speed modernization of building codes will be discussed in an early issue. The experience of Wisconsin, which has had state regulation since 1911, and the Indiana Enabling Act will be summarized as a basis for proposed uniform state codes.

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Number of copies of this issue printed: 36,893

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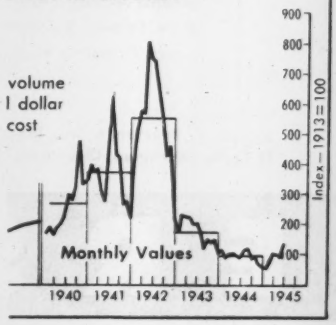
OLUME INDEX

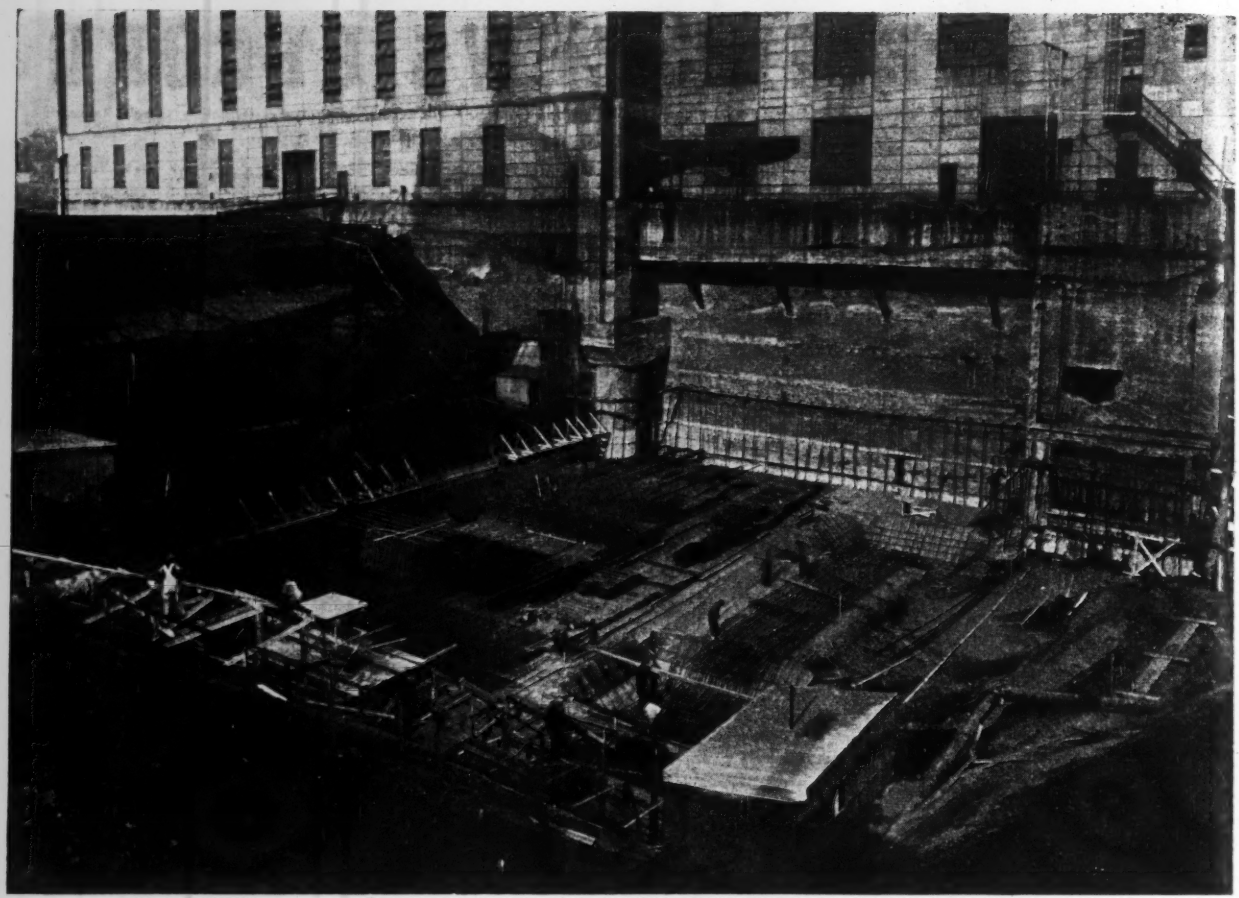


NEW PRODUCTIVE CAPITAL

	1945 (28 wk.)	Cumulative 1944 (28 wk.)
NON-FEDERAL	$466,188	$202,031
Corporate Securities	90,408	85,345
State and Municipal	212,180	60,556
RFC Loans	24,600	56,130
REA Loans	60,000	.....
Fed. Aid, Highway	79,000	.....
FEDERAL	$1,005,325	$245,266
Total Capital	$1,471,513	$447,297

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost	July '45	308.99	148.53
Building Cost	July '45	239.64	129.54
Volume	June '45	133	58



POWER PLANT ADDITION—THE OHIO POWER CO., PHILO, OHIO
Engineers of Project—American Gas and Electric Service Corp.
General Contractor — Sollitt Const. Co., Inc., South Bend, Ind.

Problem: To excavate 53 feet deep in sand and gravel for a power plant addition adjacent to an existing structure—with approximately 20 feet of water to handle.

Solution: Install a MORETRENCH WELLPOINT SYSTEM to keep the water out of sight—and out of mind.

Its: Banks were sloped. Excavation made in perfect safety without the [illegible] dam. Walls poured without inter-
[illegible] MONEY SAVED!

the right solution!

PORATION

Rockaway, New Jersey

3, Louisiana

New Construction in June

CIVIL ENGINEERING construction volume in continental United States totals $190,614,000 for the four weeks of June, an average of $47,654,000 per week and the highest weekly average volume reported since November 1943. The June average week is 45 percent above that for May, 1945, and is up 51 percent compared with June 1944.

Private construction, on the weekly average basis, tops the preceding month by 145 percent, is 152 percent higher than in the corresponding 1944 month, and the highest figure recorded since November 1943. Public work, in reporting its highest average since last August, is 19 and 25 percent higher, respectively, than a month ago and a year ago. Both state and municipal construction and federal volume participate in the public increase, the former recording 33 and 44 percent gains over last month and last year, and the latter recording a 14 percent gain over May 1945 and an 18 percent increase over June 1944.

The June construction total brings 1945 volume to $876,155,000, for the first half of the year, a figure within 2 percent of the $891,830,000 for the opening six months of 1944. Private construction, $256,855,000, is 28 percent greater than a year ago, but public work, $619,300,000 is 10 percent lower. Federal volume, $487,306,000, declines 16 percent from the 1944 period's total and is responsible for the decrease in the public figure as state and municipal construction, $131,994,000, is 21 percent higher than a year ago.

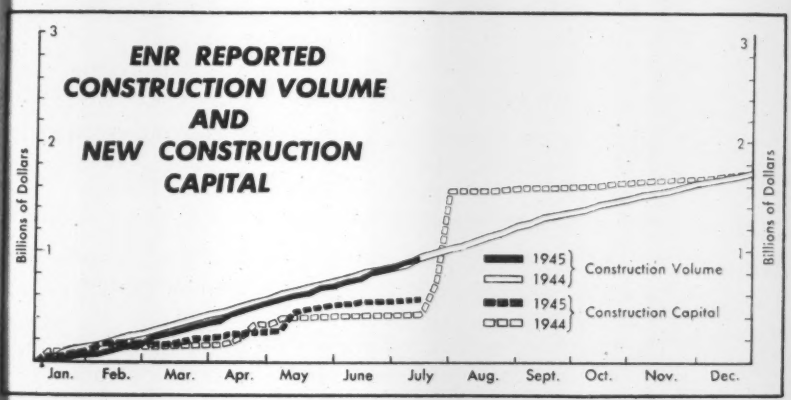
Industrial building volume for the first half of 1945 tops the 1944 half-time total by 118 percent and is the factor behind the rise in private volume. Three other classes of construction also exceed their respective first-half totals for 1944: waterworks climbs 42 percent; sewerage, 7 percent; and bridges, 91 percent.

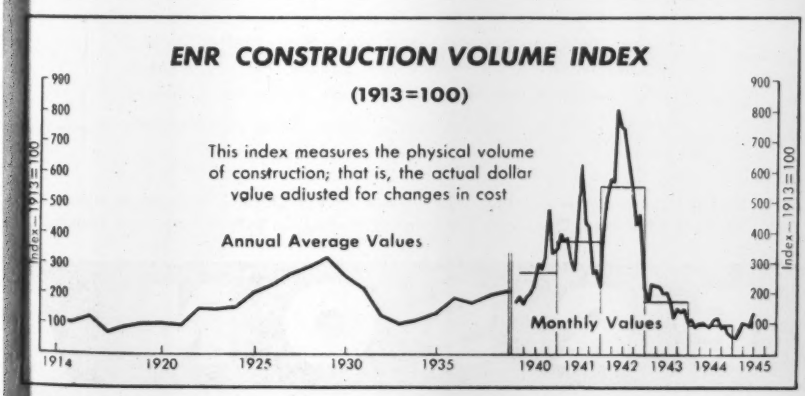
New capital

New capital for construction purposes for the four weeks of June totals $28,041,000, a volume that compares with $16,728,000 for the five weeks of June 1944. The current month's total is made up of $21,483,000 in state and municipal bond sales, $4,858,000 in corporate security issues, $1,500,000 in RFC loans for private industrial expansion, and $200,000 in RFC loans for public improvements.

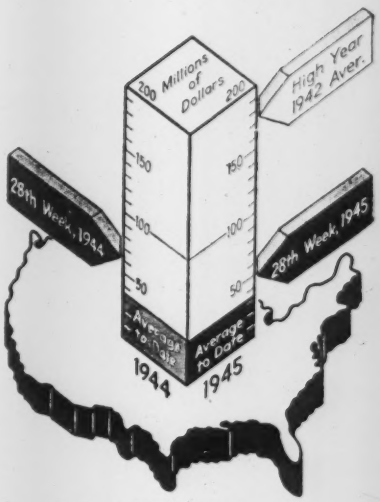
New construction financing for the first half of 1945 totals $539,751,000, a volume 22 percent greater than the $443,277,000 reported for the corresponding period in 1944.

(See Volume Table, page 85)





CONSTRUCTION ACTIVITY



As Reported This Week to...
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of July 12 1945	Cumulative 1945 (28 wk.)	Cumulative 1944 (28 wk.)
Federal	$29,369	$528,441	$639,299
State & Municipal	9,390	147,743	121,668
Total Public	$38,759	$676,184	$760,967
Total Private	10,250	279,800	212,295
U. S. Total	**$49,009**	**$955,984**	**$973,262**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Type of Work	Dollar Volume (Thousands) This Week	Cumulative 1945 (28 wk.)	Cumulative 1944 (28 wk.)
Waterworks	$996	$22,219	$15,915
Sewerage	624	15,584	14,753
Bridges	292	13,565	7,023
Highways	8,345	107,582	110,271
Earthwork, Waterways	$47	21,066	33,557
Buildings, Public	15,490	324,871	351,997
Industrial	6,397	190,205	86,450
Commercial	2,665	55,175	93,258
Unclassified	13,353	205,717	260,038

NOTE: Minimum size projects included are: Waterworks and waterway projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1945 (28 wk.)	Cumulative 1944 (28 wk.)
NON-FEDERAL	$466,188	$202,031
Corporate Securities	90,408	85,345
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RFC Loans	24,600	56,130
REA Loans	60,000	.....
Fed. Aid, Highway	79,000	.....
FEDERAL	$1,005,325	$245,266
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ENR INDEX NUMBERS

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Building Cost	July '45	239.64	129.54
Volume	June '45	133	58

WRITE FOR
HI-BOND BULLETIN

Greater Grip with Hi-BOND Re-Bars

Note the deep impression and intense pattern of Hi-Bond as compared with other reinforcing bars rolled in the same wet cement. This shows unmistakable evidence of greater mechanical grip.

The double reverse helical rib formation of Hi-Bond is scientifically designed for two purposes. The heavy fillets provide the maximum shear strength in relation to the cross section area of the bar. The spacing of the ribs affords the strongest known mechanical grip between steel and concrete for each particular size of bar.

Pull tests with Hi-Bond bars imbedded in concrete show no measurable slippage until after the yield point of the bar has been exceeded. No ordinary reinforcing bars can match this grip performance.

Ryerson has complete facilities for meeting your specifications with reinforcing bars cut, bent, welded and tagged for quick placement. Call Ryerson for reinforcing and always specify Hi-Bond.

We will be glad to send you a new technical bulletin reporting results of tests on Hi-Bond and other reinforcing bars.

Hi-Bond bars are carried in stock for immediate shipment at our Chicago, Detroit and Cincinnati plants.

1 Hi-Bond Reinforcing Bar.

2 Standard Design Longitudinal Lug.

3 Standard Design Transverse Lug.

Other products in stock: Structurals, Bars, Plates, Sheets, Inland 4-Way Floor Plate, Steel Spirals, Electric Welded Wire Fabric, Reinforcing Accessories, Forms for Concrete Joist Construction, Caisson Rings, Bolts, Rivets, etc.

Joseph T. Ryerson & Son, Inc., Steel-Service Plants: Chicago, Milwaukee, Detroit, St. Louis, Cincinnati, Cleveland, Pittsburgh, Philadelphia, Buffalo, New York, Boston.

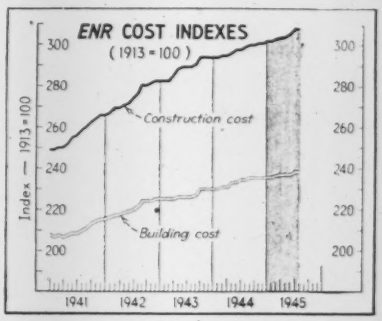
RYERSON

JULY CONSTRUCTION BUSINESS REPORT

ENR CONSTRUCTION VOLUME AND NEW PRODUCTIVE CAPITAL

(,000 omitted)	June 1944	June 1945	% Change†	Six Months 1944	Six Months 1945	% Change
Total U. S. Construction	$157,811	$190,614	+51.0	$891,830	$876,155	−2.0
Private Construction	32,569	65,714	+152.0	201,481	256,855	+28.0
Public Construction	125,242	124,900	+25.0	690,349	619,300	−10.0
Federal	93,555	88,317	+18.0	580,913	487,306	−16.0
Total New Productive Capital	$16,728	$28,041	+110.0	$443,277	$539,751	+22.0
Private Investment	14,378	26,341	+129.0	141,881	266,141	+88.0
Federal (non-federal work)	2,350	1,700	−9.0	56,130	22,600	−60.0
Federal (federal work)	.....	.....	.....	245,266	251,010	+2.0
ENR Construction Volume Index, 1913–100	91	133	+46.0	100*	95*	−5.0

† *Adjusted for difference in number of weeks reported.* * *Six-month average.*



CONSTRUCTION COSTS....WAGE RATES....MATERIAL PRICES

	July 1944	July 1945	% Change	Change June to July 1944 June	1944 July	1944 %	1945 June	1945 July	1945 %
ENR Construction Cost Index, 1913 = 100‡	299.94	308.99	+3.0	298.72	299.94	+0.4	308.99	308.99	0
ENR Building Cost Index, 1913 = 100‡	235.55	239.64	+1.7	235.33	235.55	+0.1	239.37	239.64	+0.1

‡ *Does not reflect increased costs due to overtime, lower labor efficiency, delivery delays, etc.*

ENR 20-CITIES' AVERAGE

Common Labor	$0.882	$0.916	+3.8	$0.877	$0.882	+0.6	$0.916	$0.916	0
Skilled Labor (Av. 3 trades)	1.638	1.665	+1.6	1.638	1.638	0	1.661	1.665	+0.2
Bricklayers	1.736	1.770	+2.0	1.736	1.736	0	1.762	1.770	+0.5
Structural Ironworkers	1.694	1.716	+1.3	1.694	1.694	0	1.712	1.716	+0.2
Carpenters	1.484	1.510	+1.8	1.484	1.484	0	1.510	1.510	0
Cement, per bbl	$2.66	$2.74	+3.0	$2.65	$2.66	+0.4	$2.74	$2.74	0
Reinforcing steel, cwt	2.80	2.79	−0.4	2.79	2.80	+0.4	2.79	2.79	0
Structural steel, base	2.10	2.10	0	2.10	2.10	0	2.10	2.10	0
Sand, per ton	1.23	1.24	+0.8	1.23	1.23	0	1.24	1.24	0
Lumber, Fir, 2x4, per M ft	54.28	55.87	+2.9	54.28	54.28	0	55.87	55.87	0
Lumber, Pine, 2x4, per M ft	53.09	53.44	+0.7	52.68	53.09	+0.8	53.44	53.44	0
Common brick, per M	16.52	18.51	+12.0	16.41	16.52	+0.7	18.46	18.51	+0.3
Ready-mixed concrete, c. y.	7.43	7.58	+2.0	7.39	7.43	+0.5	7.60	7.58	−0.3
Struct. clay tile, 3x12x12	80.48	84.75	+5.3	79.97	80.48	+0.6	84.75	84.75	0
Paving asphalt, cars, ton	15.40	15.48	+0.5	15.25	15.40	+1.0	15.48	15.48	0

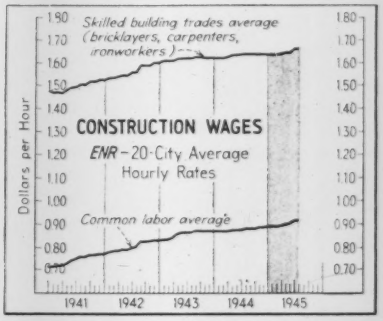
ENR INDEX NUMBERS

Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
July, 1945	308.99	148.53	239.64	129.54		
June, 1945	308.99	148.53	239.37	129.40	133	58
May, 1945	307.43	147.78	238.46	128.90	93	41
Apr., 1945	306.43	147.30	238.46	128.90	99	43
Mar., 1945	304.50	146.37	237.85	128.57	103	45
Feb., 1945	303.70	145.99	237.71	128.50	78	34
Jan., 1945	302.50	145.41	236.51	127.85	63	28
Dec., 1944	302.30	145.32	236.51	127.85	66	29
Nov., 1944	301.09	144.73	236.10	127.63	74	33
Oct., 1944	301.06	144.72	236.00	127.57	91	40
Sept., 1944	300.46	144.43	236.00	127.57	85	37
Aug., 1944	300.42	144.41	236.09	127.62	121	53
July, 1944	299.94	144.18	235.55	127.33	114	50
June, 1944	298.72	143.59	235.33	127.21	91	40
1944 (Av.)	298.64	143.59	234.73	126.89	96	42
1943 (Av.)	289.95	139.38	228.75	123.66	176	77
1942 (Av.)	276.31	132.82	222.39	120.22	553	243
1941 (Av.)	257.84	123.95	211.46	114.32	375	164

MATERIAL SHIPMENTS .... BUILDING PERMITS

	June 1944	June 1945	% Change	May 1945	% Change May-June
Steel (% of operating capacity) A.I.S.I.	97.0	90.4	−6.8	93.6	−3.4

	May 1944	May 1945	% Change	Five Months 1944	Five Months 1945	% Change
Fabricated Structural Steel, tons, A.I.S.C.	50,651	54,444	+7.3	214,598	266,074	+23.9
Cement, thous. bbl., U. S. B. of M.	8,784	9,272	+5.5	32,484	33,601	+ 3.3
Building Permits, 215 cities, Dun & Bradstreet (,000 omitted)	$55,426	$75,397	+36.0	$250,266	$321,527	+28.5



COST OF LIVING INDEX .... CIVIL NON-AGRICULTURAL EMPLOYMENT

	May 1944	May 1945	% Change	April 1945	% Change Apr.-May
Cost of Living Index (N.I.C.B.)	104.6	106.2	+1.5	105.8	+0.4
Rent (Housing) Index (N.I.C.B.)	90.8	91.0	+0.2	91.0	0
Total Employment (est.) thous., B.L.S.	38,672	37,654	−2.6	37,804	−0.4
Constr. Employment (est.) thous., B.L.S.	686	747	+8.8	690	+8.2

ENGINEERING CONSTRUCTION CONTRACTS — ENGINEERING NEWS-RECORD — JUNE, 1945

Engineering News-Record *reports continental U. S. Construction projects of the following minimum costs—waterworks, excavation, drainage and irrigation,* $15,000; *other public works,* $25,000; *industrial buildings,* $40,000; *other buildings,* $150,000

Four weeks—Thousands of Dollars (000 Omitted)

Public Works	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States June 1945	United States Six Months 1945	United States Six Months 1944	Canada
Waterworks	335	160	398	397	1,023	483	2,796	19,797	13,975	176
Sewerage	14	330	296	201	776	1,021	2,638	14,623	13,629	100
Bridges, public	457	26	307	38	317	642	1,787	9,253	5,423	52
Earthwork and waterways	49	192	877	.....	586	3,740	5,444	19,871	32,691	101
Streets and roads	315	4,286	4,679	7,342	6,220	3,919	26,961	94,212	97,637	381
Buildings, public	3,029	6,770	3,661	2,601	6,222	6,787	29,070	305,727	333,624	2,064
Unclassified, public	3,839	4,227	6,029	600	3,449	38,060	56,204	155,817	193,370	342
Total public	**8,038**	**15,991**	**16,247**	**11,379**	**18,593**	**54,652**	**124,900**	**619,300**	**690,349**	**3,216**
Federal government (included in above classifications)	3,972	11,307	10,434	2,746	10,790	49,068	88,317	487,306	580,913	.....
Private										
Bridges, private	.....	.....	.....	.....	.....	.....	.....	3,331	1,325	.....
Industrial buildings	979	8,300	454	29,500	2,755	6,438	48,426	180,751	83,000	2,882
Commercial buildings	1,890	4,155	250	.....	600	2,473	9,368	44,290	88,541	4,723
Unclassified, private	105	172	129	2,217	4,836	461	7,920	28,183	28,615	300
Total private	**2,974**	**12,627**	**833**	**31,717**	**8,191**	**9,372**	**65,714**	**256,855**	**201,481**	**7,905**
Total Engineering Construction:										
June, 1945—4 weeks	**11,012**	**28,618**	**17,080**	**43,096**	**26,784**	**64,024**	**190,614**	.....	.....	**11,121**
May, 1945—5 weeks	8,976	19,108	35,296	22,712	39,319	39,544	164,955	.....	.....	10,098
June, 1944—5 weeks	4,158	22,108	34,736	23,604	29,858	43,347	157,811	.....	.....	11,728
Six Months—1945	**37,918**	**120,385**	**151,823**	**138,140**	**198,141**	**229,748**	.....	**876,155**	.....	**56,204**
Six Months—1944	25,044	134,512	155,583	111,669	139,125	325,897	.....	.....	**891,830**	44,672

Atlas Duraplastic

Air-Entraining Portland Cement

• • •

Makes Better Concrete at No Extra Cost

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ENR-D-19

The Week In Engineering and Construction

ENGINEERING NEWS-RECORD • JULY 12, 1945 • VOLUME 135 • NUMBER 2

Stream pollution abatement gathering momentum

North Carolina and Washington control commissions get under way, and Pennsylvania board has issued orders to 300 communities to make treatment plans

Developments in widely separated parts of the country within recent weeks reveal that increasing attention is being focused on stream-pollution abatement measures. North Carolina has just established a 16-man commission to recommend remedial measures, and in Washington the recently organized pollution control commission cited 55 cities as having unsuitable sewage disposal facilities. In Pennsylvania, where the Sanitary Water Board previously had notified some 200 municipalities to prepare plans for sewage treatment works, an additional 92 communities were given similar notice.

Meantime, at Columbus, Ohio, the city was preparing a defense against 76 damage claims for alleged pollution of the Scioto River. And in Illinois the state has instituted court action designed to eliminate waste entering Lake Michigan from industrial plants in Indiana.

North Carolina commissioners

In North Carolina, where the 1945 legislature authorized the establishment of a state stream sanitation and conservation commission, a 16-man body has just been appointed. Its members, representing state, industrial and public interests, will investigate pollution of watercourses and recommend remedial measures.

Included on the commission are: James M. Jarrett, chief engineer of the N. C. State Board of Health; W. H. Riley, an engineer of the Department of Conservation and Development; and H. G. Baity, professor of sanitary engineering at the University of North Carolina.

Washington initiates action

The newly-organized Washington State Pollution Control Commission has listed 55 cities in that state as having unsatisfactory methods of sewage disposal requiring "immediate attention." Included in the group are Seattle, Aberdeen, Bellingham, Centralia, Hoquiam, Longview, Kelso, Port Angeles, Port Townsend, Shelton and Wenatchee.

Spokane, Everett, Tacoma, Vancouver and Olympia were cited as having recognized the necessity of correcting "unsatisfactory methods" and having undertaken preliminary corrective steps.

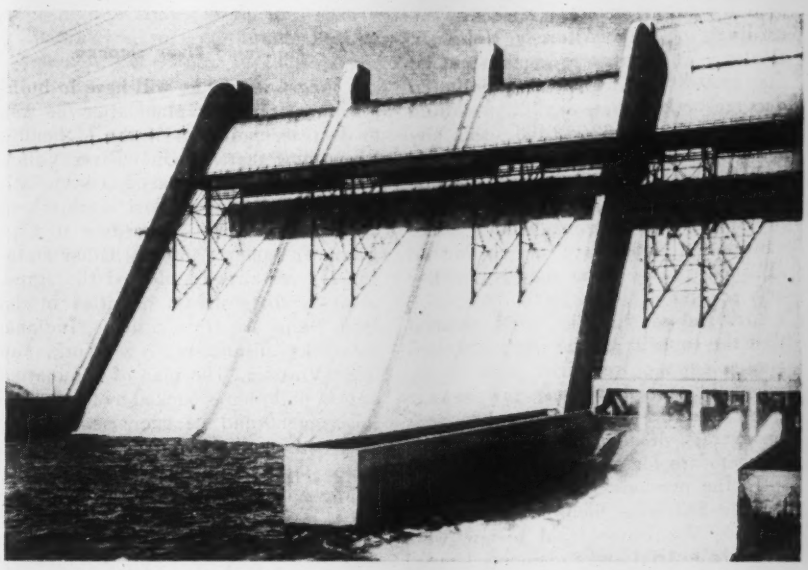
The commission, instituted by the 1945 state legislature, is composed of the state directors of game, agriculture, health and the department of conservation and development. Its first steps were to outlaw irrigation with sewage and the use of sewage sludge for fertilizer except in cases where the state health department gives its approval.

Both the commission and the state health department must be consulted before cities and industrial plants can build new sewage plants or alter existing plants.

Declaring that the period of August 13-20 is to be "Stream Improvement Week", Gov. Ralph F. Gates of Indiana has issued a proclamation calling upon all citizens of that state to change their "attitude of apathy to one of action" toward abatement of pollution.

The proclamation stated that since Indiana ranks only twenty-first in the

(*Continued on next page*)



First water flows over Friant Dam

Millerton Lake behind Friant Dam on the San Joaquin River, part of the Central Valley Project in California, reached the crest of the 250-ft. high spillway for the first time late in June and began to overflow as abnormally high temperatures increased the snowmelt in the Sierra-Nevada Mountains. At the present spillway level the reservoir has a capacity of 436,500 acre-ft. This capacity will be increased by 84,000 acre-ft. with the installation of three 18x100 ft. drum gates on the crest, expected at an early date. Flow of water over the spillway augments the controlled discharges through the river outlet and the Madera Canal discharge valves. A total of 4,000cfs. is being released.

United States so far as pollution control is concerned, with only 59.7 percent of the urban population served with sewage treatment facilities, "this bad showing" might be traced to apathy. The call to action was sounded so that the state could achieve its proper standing in the nation and improve sanitary conditions.

Action in Pennsylvania

Continuing a vigorous compaign directed toward postwar stream pollution curtailment that was initiated a year ago, the Pennsylvania Sanitary Water Board has now notified 92 communities to prepare plans for the construction of sewage treatment works. This group is in addition to some 200 municipalities previously cited (*ENR* Feb. 15, 1945, vol. p. 228).

Issuance of these orders, which are backed by state legal powers, is the outcome of ten hearings held by the sanitary board last summer at which municipalities, industries and other interested parties were informed of the board's intention to enforce remedial measures.

Damage claims at Columbus

Within recent months a total of 76 cases seeking the recovery of more than $500,000 in alleged damage claims from the city of Columbus, Ohio, for polluting the Scioto River, have been filed by downriver farm residents, according to City Attorney John L. Davies. The suits are reminiscent of the 1930-40 era, when 288 pollution damage actions were instituted calling for payment of $2,742,400; the city settled these cases for $172,744.

Bases for the present suits include odor nuisance indictments and damage to river-bottom farming land. Other causes for action are destruction of nails on houses along the river valley and scaling of paint on buildings.

Mr. Davies said the suits contend that the capacity of the city's activated sludge sewage treatment plant is inadequate and that some raw sewage flows into the river. The suits seek an average of about $10,000, but most of them are for less than that amount.

In the previous settlement of claims on the 288 suits filed in the ten-year period, Mr. Davies said a few were brought to trial and judgments handed down by the court. Others, he recalled, were settled on the basis of the court judgments. Settlements averaged $599 apiece, he added.

Illinois takes action

Twenty-one industries in East Chicago, Gary and Whiting, Ind., were made parties to the Lake Michigan pollution action instituted in October, 1943, (*ENR*, Oct. 28, 1943, v.p. 645 and Feb. 10, 1944, v.p. 169) by the State of Illinois against the State of Indiana and four Indiana cities in an amended complaint filed recently by Atty. Gen. Barrett before the U. S. Supreme Court in Washington, D. C.

The chief reason for the amended complaint is to make any agreements reached with these industries a matter of court record and to insure execution of the agreements. Negotiations already have been instituted against some of the industrial firms, according to Mr. Barrett, to eliminate the discharge of industrial wastes and raw sewage into Lake Michigan.

Since filing the original complaint, reported Mr. Barrett, agreements have been reached with the four cities of Hammond, Gary, East Chicago and Whiting, to provide for the proper treatment of their domestic sewage as soon as possible. The five Gary industries are reported to have submitted plans for piping sewage and industrial wastes to the Gary sewage treatment plant. East Chicago recently started operating its new sewage treatment plant, said Mr. Barrett, and efforts will be made for the treatment of industrial wastes from the 14 offending plants located there. An agreement also has been reached with the American Maize Products Co., Hammond, for the installation of extensive equipment to treat its industrial wastes.

Mahoning River cleanup

Youngstown, Ohio, will have to build a sewage treatment plant after the war to decrease pollution of the Mahoning River, now that the Ohio River Valley water sanitation compact has been ratified by Pennsylvania, last signatory to the interstate pact, according to City Engineer James C. Ryan. Other states which have already adopted the agreement to abate stream pollution in the Ohio basin are Ohio, Illinois, Indiana, Kentucky, Tennessee, New York, and West Virginia. The plan of eliminating stream pollution is backed by the federal government and its agencies, and the pact was authorized by Congress in 1936.

Mayor Ralph W. O'Neill wants to start a preliminary sewer survey in Youngstown, leading to preparation of plans for a modern sewage disposal system, perhaps employing a consulting engineer this year to prepare a report and preliminary sewer survey. This, however, is dependent upon the outcome of a pending suit as to the constitutionality of a 2½ percent levy on the customer bills of utility companies. The funds expected from this source are said to be the only money likely to be available for a sewer survey.

Engineers make plans for returned soldiers

Ways in which the construction industry can aid returned soldiers in getting reestablished in business or in completing their education or apprentice training were discussed in Washington on June 25 at a conference called by William N. Carey, secretary of the American Society of Civil Engineers, at the request of Day I. Okes, St. Paul, Minn., chairman of the executive committee of the society's Highway Division.

Representatives of 21 engineering and architectural societies, government agencies interested in the placement and training of veterans, educational institutions and the U. S. Chamber of Commerce were present. Those directly interested in construction, in addition to Messrs Carey and Okes were E. L. Chandler, Washington representative of the A.S.C.E.; J. W. Follin, Producers Council; Hal H. Hale, American Association of State Highway Officials; Edmund R. Purves, American Institute of Architects; Charles Upham, American Road Builders Association; Ivan C. Crawford of the University of Michigan; Scott B. Lilly, Swarthmore College, and F. Stuart Fitzpatrick, U. S. Chamber of Commerce.

Present arrangements for helping veterans to get reestablished in civil life were outlined by the representatives of the Veterans Placement Service; apprentice training was discussed by the spokesman for the War Manpower Commission; and educational plans were reported by Dean Crawford and Prof. Lilly.

In all the discussions, emphasis was laid on the fact that veteran placement is being handled at the local level and that aid to men returning to the construction field or to men anxious to enter that field must be operated at the local level to be effective.

In the end it was decided that the first thing to be done was to prepare a manual setting forth the opportunities in the construction field for returning soldiers for further education, apprentice training or construction jobs, also to list the agencies from which the veterans could obtain guidance.

Preparation of the manual is to be placed in the hands of a subcommittee of the permanent committee that was appointed at the close of the conference to organize and arrange to finance the program outlined at the conference. This committee is to be known as the Committee on Opportunities for Veterans in the Construction industry. Day I. Okes is chairman, F. Stuart Fitzpatrick is vice chairman, and E. L. Chandler is secretary.

Big irrigation program started in Mexico

The National Irrigation Commission of Mexico has announced a $31,000,000 irrigation project which will take three years to complete. In all, 59 irrigating units will be built to intensify agriculture in the country. The federal government has advanced $3,000,000 to start the project, with states contributing another $1,000,000.

Three dams have already been started. La Esperancze in the state of Hidalgo, Atoyac in Puebla, and Atlacomulco in Puebla. New constructions will be started this year in Nuevo Leon, Coahuila, Michoacan and Colima. Before the end of 1945, other works will have been started, if plans of the commission are kept up.

Idaho municipal bonds on more liberal basis

To encourage the construction of public works by municipalities, the 1945 Idaho state legislature empowered cities to issue municipal coupon bonds aggregating 15 percent of the assessed full cash valuation of real estate and personal property, an increase of 50 percent over previous limitations.

Such bonds may be issued to finance sewerage systems, service men's memorials, streets, hospitals, parks and public buildings.

The legislature also authorized Idaho cities to increase tax levies for general revenue and municipal purposes to 20 mills for the years 1945 to 1950 inclusive, as compared to the previous limitation of 15 mills.

New Pacific divisions, Bur. of Yards and Docks

Rear Adm. C. H. Cotter, C.E.C., U.S.N., has been made Director, Western Pacific Division, Bureau of Yards and Docks, and Rear Adm. J. J. Manning, C.E.C., U.S.N., has been assigned to duty as Director, Eastern Pacific Division, with headquarters in San Francisco, it is announced.

Subdivision into two parts of the area formerly under Admiral Cotter's direction was made necessary by the greatly increased area in the Pacific taken over by our forces. Under the new plan of operation, Admiral Cotter will spend more time in the forward areas and will be able to intensify supervision of construction activity of the very large number of Seabees now in those areas.

Permeable jetties built to protect Cleveland's shore

The first of five projected permeable jetties has been completed at Cleveland as part of a program to halt erosion of the Lake Erie waterfront in Edgewater Park.

The new groins are of concrete, built to designs developed for use on Lake Michigan. A groin of this type was built about a year ago at East 150th St., Cleveland. It was supported on piles and about half of it was washed away in storms during the winter.

The groins at Edgewater Park are set directly on the flat shale rock that is exposed there. They will be placed 230 ft. apart and will extend from 153 to 289 ft. into the lake to reach water depths of about 8 ft. It is hoped that these groins will slow down the movement of water along the shore and cause the building of beaches.

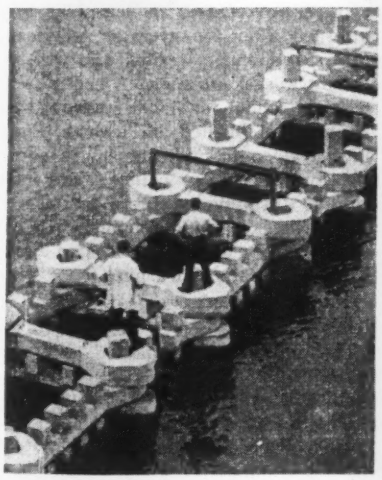
The various units that are assembled to form the groins are of lightly reinforced concrete, precast in steel forms in a yard near the site and are set in place by a derrick mounted on a scow.

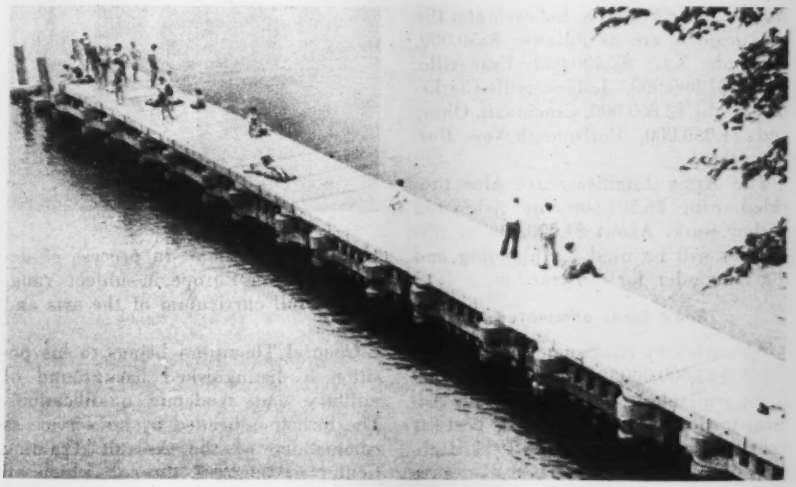
At the site, the rock surface is leveled off to receive the bottom units, shims being used to bring them to proper elevation. Other units are assembled on these, as shown in the accompanying illustrations, concrete dowels being inserted at the corners of each group to lock the units together.

At the outer end the dowels are replaced by posts reinforced with an 8-in. H-beam and cast integral with a pedestal block. The top of each H-beam is left exposed, and after the units have been assembled, steel stringers are welded to the top to carry the deck. Subsequently the stringers are encased in concrete.

Over the remainder of the jetty, the precast deck slabs have flanges at each end that fit down over the upper horizontal units and are bolted to them. The latter units have not been set in the section of the jetty shown at the left. Tops of the dowels are cut off where necessary.

Designs for these groins were developed and have been patented by Sydney Makepeace Wood, consulting engineer, Lake Bluff, Ill. The work in Cleveland is being done by the direction of John C. Wenrick, city engineer. Samuel Newman is engineer of the Park Department. Contract for the work, which is expected to cost $110,000, is held by Ralph W. Walton, general contractor, Cleveland.





Precast concrete units are being used at Cleveland to build permeable jetties in an experimental attempt to check erosion of the shore line and to build up beaches for recreational use.

Department of Commerce to set up new federal construction agency

Funds for new agency inserted in a deficiency bill, which also allots money to FWA for community facilities and to the Army Engineers for flood control

Creation of a new federal construction agency within the Department of Commerce has been made possible by the inclusion of $75,000 for that purpose in a deficiency bill (H.R. 3579) signed by the President early this month. With this money the Bureau of Foreign and Domestic Commerce plans to set up a construction division to work with the industry on matters of common interest. The new division is planned to (1) provide a central office in the federal government where problems of the construction industry can be considered; (2) coordinate the construction program of the different governmental agencies; and (3) secure cooperation of private interests in producing a large yearly volume of construction.

Details as to who will head the new division and how it will function are not available as yet.

Funds for construction

The deficiency bill also appropriates $20,000,000 for use of the Federal Works Agency for construction of community facilities in accordance with the Lanham Act. In approving this item, Congress wrote into the bill a requirement that projects costing the federal government less than $250,000 be given priority.

A sum of $8,906,000 is provided for flood control by the U. S. Army Engineers. This money is expected to be spent for five projects shut down because of the war and now to be resumed. The amount to be available for each and the five projects are as follows: $550,000, Paducah, Ky.; $2,400,000, Evansville, Ind.; $1,096,000, Jeffersonville-Clarksville, Ind.; $2,860,000, Cincinnati, Ohio; and $1,050,000, Portsmouth-New Boston, Ohio.

The Army Engineers are also provided with $6,504,600 for river and harbor work. About $4,000,000 of this amount will be used for planning and the remainder for construction.

Road funds eliminated

As passed by the Senate the bill supplied $25,000,000 of the $100,000,000 to be available to the Public Roads Administration during the first postwar year in accordance with the 1944 Highway Act. The Senate version also gave PRA authority to enter into contracts not to exceed an additional $75,000,000. But, the House prevented approval of this part of the bill, and last week new legislation was introduced to permit PRA to go ahead in this manner. However, congressional approval of the proposal is not expected before September.

Star for Paul W. Thompson school head in E.T.O.

Following close upon the disclosure by General Eisenhower in Paris, June 4, that Paul W. Thompson had been appointed chief of the Information and Education Division, American Army in the European Theater, the President recommended his promotion from colonel to brigadier general, and on June 21 the Senate confirmed the recommendation. In his new post, General Thompson is charged with the supervision of schooling for approximately 1,250,000

men, stationed in or in process of deployment from Europe, in subjects ranging the full curriculum of the arts and sciences.

General Thompson brings to his position a distinguished background of military and academic qualifications. The former is headed by his service as commander of the Assault Training Center in England, through which all of the troops who took part in the initial phases of the European invasion had to pass and get a diploma, as it were. Upon completion of this important assignment, General Thompson led the 6th Engineer Special Brigade in the D-Day assault on Omaha Beach in Normandy, where he was seriously wounded while personally leading a group of volunteers against heavy enemy machine gun emplacements. Awarded the Distinguished Service Cross for his gallantry, General Thompson was hospitalized home, and later was assigned to the Plans and Operations Division of the War Department General Staff, Washington.

A graduate of the U. S. Military Academy, Paul Thompson was commissioned a second lieutenant of the Corps of Engineers in June, 1929. In 1932 he received a Bachelor of Science degree in Civil Engineering, from the University of Iowa, and immediately following his graduation began 16 months service as assistant to the director, U. S. Waterways Experiment Station, Vicksburg. In 1935-1937, as a Freeman Scholar, he took postgraduate work in hydraulics in Germany. From July, 1940, to July, 1943, he was assistant to the chief, Intelligence Section, Office, Chief of Engineers, Washington.

All levels of instruction

The educational program which General Thompson heads up was completely organized and ready to go when V-E Day arrived. The program embraces schools arranged in various levels of learning, as in the American school system, and academic and vocational instruction will be available at the upper elementary, high school, technical school and college levels.

The program will revolve around two university centers, operated by American personnel at Shrivenham, England, and Fontainebleau, France. Courses at these two centers of learnings are patterned after the average American university summer session, and will be of eight weeks' duration. A centralized technical school for 4,000 students has also been established at Titworth, England, to open in mid-August. In addition, foreign civilian colleges and universities will provide courses on a short-term basis, and "unit schools" will be established for army units located away from fixed seats of learning.

The military construction division, Office of the Chief of Engineers, has handled a program of $11,500,000,000, of which work amounting to some $11,143,000,000 is in place. The supply division has purchased about $6,500,000,000 worth of engineer supplies since Pearl Harbor.

H. R. committee favors $700,000,000 of federal aid for airport work

New bill introduced provides, over a 10-yr. period, $650,000,000 for work in U. S. and $50,000,000 for construction in territories

To permit the large national airport plan submitted to Congress last November by the Civil Aeronautics Administration to be carried out, the House Committee on Interstate and Foreign Commerce recently introduced and recommended for passage a bill (H.R. 3615) providing extensive federal aid for that work. When combined with local matching funds the federal money would permit an airport program costing nearly $1.4 billion.

The plan recommended by the CAA last November calls for extensive construction (See *ENR* Dec. 7, 1944, vol. p. 725 for details). The general proposal is to construct 3,050 new airports and to improve 1,625 existing fields. The estimated cost is over $1,021,000,000 for grading, paving, lighting and radio facilities, plus about $230,000,000 for land and buildings other than hangars.

To carry out that part of the program within the continental limits of the United States the bill authorizes annual federal appropriations not exceeding $100,000,000 yearly and aggregating $650,000,000 over a 10-yr. period. Of these appropriations 75 percent would be apportioned among the various states on the basis of population and area and the remaining 25 percent would be allocated in a manner the administrator of the CAA considers most effective to complete the national airport plan.

Grants directly to sponsors

The aid for work in a given state would be channeled through that state's aeronautics commission or other state agency if so required by state law. Otherwise, all grants in the cases of the states would be made directly to the sponsor of the project, whether a state body, city government, county department or a public corporation.

For that part of the program requiring construction in the territories and possessions, the bill authorizes an appropriation of $50,000,000 over a 10-yr. period. This money would be used as the CAA administrator determines best. However, not over $10,000,000 of the aid could be expended in Alaska, only $15,000,000 in Hawaii, and no more than $10,000,000 in Puerto Rico.

The new bill authorizes the federal government to meet 50 percent of the allowable construction costs of an approved project. Developments in Alaska are an exception, as in this work the federal share may be as high as 75 percent. Project costs which may be shared by the federal government include all general necessary costs incurred in constructing the airfield, but do not include those of building hangars or acquiring the necessary land.

The House proposal differs appreciably from the bill (S.2) recommended to the Senate by the Senate Committee on Commerce (See *ENR* May 10, 1945, vol. p. 682 for details). The Senate measure would provide a total of $500,000,000 of federal aid to be made available at the rate of $100,000,000 yearly over a 5-yr. period. The Senate Committee felt that a 5-yr. schedule would be best if the aviation industry is to assume its proper place in the postwar period. A compromise between those advocating an airport program on a federal-state basis and those supporting a federal-city basis was also recommended by the Senate committee.

Passage by Congress of a compromise bill is expected soon after the House gets back from the summer recess it now has planned.

JOBS OF THE WEEK

PIERS, California Point, Calif.

Duncanson Harrelson Co. and Healy Tibbitts Construction Co., San Francisco, Calif., have been awarded a contract by the U. S. Engineers, San Francisco, Calif., for constructing piers, at $3,330,730.

AIRPORT, Wilkes-Barre and Scranton, Pa.

Civil Aeronautics Administration, New York, N. Y., received the lowest bid for clearing, grading, and drainage at airport from George M. Brewster & Son, Bogota, N. J., Schedules (1) $3,348,882, (2) $3,318,582, (3) $3,350,502 and (4) $3,320,202.

IMPROVING AIRFIELD, Barksdale Field, La.

U. S. Engineers, Little Rock, Ark., awarded a contract to improve Barksdale Field to T. L. James, Ruston, La., at $1,347,400.

STEAM BOILER PLANT, Columbus, Ohio

Columbus & Southern Ohio Electric Co., Columbus, will build by its own forces steam boiler plant, service buildings, and shop to cost about $1,709,000. Charles Gillivan, Columbus, is the chief engineer.

AIRFIELD IMPROVEMENTS, Randolph Field, Tex.

M. B. Killian and E. B. Darby, San Antonio, have been awarded a contract to construct additional airfield improvements at runway, reconstructing east and west concrete aprons and internal drainage by U. S. Engineers, Fort Sam Houston at $3,144,210.

PLANT ADDITION, Ville St. Pierre, Que.

Foundation Company of Canada, Ltd., Montreal, will build plant addition for Canadian Car & Foundry Co., Ltd., Montreal, to cost about $1,022,500 with equipment.

HOSPITAL, Campo, Calif.

U. S. Engineers, Los Angeles, Calif., awarded a contract for additional building at Mitchell Hospital to Del E. Webb Construction Co., Los Angeles at $1,957,000.

BARRACKS, Camp Cooke, Calif.

Robert E. McKee, Los Angeles, Calif., has been awarded a contract for the construction of barracks U. S. Engineers, Los Angeles, at $4,040,850.

HIGHWAY, British Columbia

Department Public Works, Victoria, awarded a contract for road from Summit Lake to Mile 94, Sect. A, Prince George-Dawson Creek Rd., to Campbell Construction Co., Vancouver, B. C., at $1,223,555, Also Section B from Azouzetta Lake to Commotion Creek, to Fred Mannix & Co., Ltd., Calgary, Alta., at $1,038,940. A. L. Carruthers, is the engineer.

Note—Additional bidding and contract news on many projects large and small, including the above items, appear in the Construction News section beginning on page 235.

OBITUARY

S. C. Durkee, 72, former Nevada state highway engineer and a pioneer of the state's modern roadbuilding program, died June 22 in Reno. One of the first on the staff of the Nevada highway department when it was organized in 1918, Mr. Durkee served as resident and district engineer at Elko and Reno. In 1927 he was appointed state highway engineer, a post he held until 1935. Earlier Mr. Durkee was a mining engineer, having spent ten years in South Africa before his work in highway engineering.

Chester Ross Davis, 55, in charge of the Carquinez and Antioch bridges in northern California since the state bought them in September, 1940, died June 13 at Mare Island, Calif. A civil engineer, he had been with the California bridge department and the San Francisco-Oakland Bay bridge administration since 1928.

D. Frazier Thomas, 54, a civil engineer with the Florida State Road Department, died June 29 in Gainesville.

Louis F. Cutter, 80, a civil engineer responsible for a large amount of survey and map work in the White Mountain region of New Hampshire, died at Randolph, N. H., on June 26. He was a graduate of the Massachusetts Institute of Technology, class of 1886, and practised at Boston for many years.

Howard J. Whitman, 59, a civil engineer who aided in construction of the New York State Barge Canal, died in Rochester, N. Y., July 1. In 1910 he was graduated from Colgate University with a civil engineering degree. After his assignment on the Barge Canal was completed, he became associated with his brother, George Whitman, in the Linn Manufacturing Co., Mt. Morris, N. Y., makers of tractors.

John E. Walker, Ocala, Fla., for 22 years county engineer of Marion County, Fla., died June 27 at New Orleans, La.

Austin C. Davis, 76, who operated the Austin C. Davis Building and Contracting Co., Toledo, Ohio, until he retired ten years ago, died in Toledo June 27.

Harry Oliver Davidson, civil engineer, died June 20 in Pittsburgh, Pa. A native of Cleveland, Ohio, Mr. Davidson was graduated from the Case School of Applied Science in 1904. He formerly had been an engineer for Hydraulic Pressed Steel Co. in Cleveland.

James Hargraves Tebbets, 63, for many years associated with Chas. T. Main, Inc., Boston, Mass., as a hydraulic engineer, and at times connected with the H. M. Byllesby organization in Chicago, Stone & Webster Engineering Corp., Boston, Bethlehem Shipbuilding Corp., in Pennsylvania, Vaughan Engineers, Boston, and lately on appraisal work with Howard M. Turner, Boston consultant, died at Boston on June 12. He was a native of Somersworth, N. H., and was educated at the Massachusetts Institute of Technology.

Maj. Clarence H. Greene, 78, retired Army construction engineer, died at Providence, R. I., on July 3. He was a graduate of Brown University, class of 1890, was a captain of Engineers in the Spanish War, and during World War I was attached to the construction division of the Quartermaster Corps, supervising camp construction throughout the country. After World War I he served as a commissioned officer in the regular army until his retirement in 1931.

Charles Butch Gray, 66, veteran civil engineer of Dallas, Tex., died at Weatherford, Tex., June 12.

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C. S. Strike to direct rehousing in Germany

Announcement was made last week by the War Department that Clifford S. Strike, president of the contracting firm of F. H. McGraw & Co., Hartford, Conn., has been appointed chief of the building materials and housing branch of the economics division of the U. S. Group Council for Germany, one of the twelve branches operating under Lt. Gen. Lucius D. Clay, engineer officer, who is deputy military governor in the U. S. Zone under General Eisenhower.

At a press conference following his appointment, Mr. Strike said that he expected his duties would keep him in Germany from six months to a year, and that his principal job would be to get under way the construction by the Germans themselves of temporary quarters for 11,000,000 persons who will need shelter this winter. On the other hand, other types of construction (such as water supply and sanitation and railroads) will also come under the jurisdiction of his branch, Mr. Strike said. Some two million Germans will be needed in the labor force and Mr. Strike pointed out that they would be paid with money provided by Germany.

A.G.C. Board meeting centered on financing

The regular spring meeting of the governing and advisory boards of the Associated General Contractors of America, held at Chicago late in June, was given over largely to discussion of a proposed plan for increasing the revenues of the association. Designed primarily to raise funds for expanded public relations and labor-relations activities, the plan will be submitted for consideration of the membership in the near future.

In his report to the meeting, H. E. Foreman, managing director, stated the plan will "provide the finances necessary for the industry-wide action which would place construction in the forefront of national prosperity." Mr. Foreman went on to say that during the immediate period ahead construction can perform a great service for the nation by acting as a cushion against the shocks of reconversion and unemployment in undertaking peacetime work while other industries are retooling. Many types of construction, he pointed out, can get under way now which will not require materials or manpower needed in the war against Japan.

Looking ahead, Mr. Foreman urged a continuation of construction planning to provide "the large reservoir of work needed upon the defeat of Japan when government agencies will be prepared to cancel the majority of war contracts in a matter of hours."

Construction opportunities abroad

In discussing various A.G.C. activities, Mr. Foreman announced that the association has made arrangements with the U. S. Department of Commerce to provide contractors with information on opportunities for foreign construction.

Labor relations received considerable attention at the meeting. Construction faces many puzzling labor questions, discussion revealed, such as what the wage scale should be when working hours per week are reduced.

The Market Development Committee reported that postwar construction work totaling 31 billion dollars has been proposed, but plans under way aggregate less than 5 billions and actually only work amounting to 3 billions has reached the completed planning stage.

In compliance with ODT rulings, the meeting was limited to an attendance of 50 persons.

The Week In Engineering and Construction
Continued on page 141

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

River and Harbor Projects

Sir: In his letter with respect to river valley authorities (*ENR* May 17, vol. p. 692) James S. Sweet mentions the stigma of "pork barrel" legislation attached to flood-control measures administered by U. S. Engineers.

Flood-control is largely river improvement work. Year after year the opponents of river and harbor legislation try to kill it by derision. "Pork barrel," they say; meaning that the bill carries appropriations for projects without merit except political. The astounding thing is that so many believe it, despite the fact that river and harbor legislation is entirely free from pork, by reason of the method of its adoption and enactment, and has been so for a generation.

In the first place, Congress does not appropriate for particular projects. It appropriates lump sums to be spent by the Secretary of War at his selection (and that means at the selection of the Chief of Engineers, U. S. Army) from a list of approved projects. And what are these approved projects?

They are projects that have been certified economically sound after long study by the Corps of Engineers, made first by the district officer, reviewed by his superior, the division engineer; then by the Board of Engineers for Rivers and Harbors, and finally by the Chief of Engineers. No part of the study is perfunctory. Many projects are rejected.

Having passed that test, the projects go to the River and Harbor or Flood Control Committee of the House, and if approved they are incorporated in an authorization bill, which carries no money. When the bill becomes law they become approved projects, to which the Secretary of War may allot funds when made available by Congress.

There is no form of government expenditure subjected to closer scrutiny as to its worth. Not to use too strong a word, labelling such legislation "pork barrel" is unscrupulous. To do so is to impugn the integrity of the Corps of Engineers and its chief, the integrity of the river and harbor and flood-control committees and the members of the House and Senate.

With over one-half of the projects investigated down through the years, the decisions by Army engineers have been adverse.

We have complete confidence in the U. S. Army Engineers. No other governmental agency has performed its duties with greater integrity and efficiency. With its unparalleled experience and familiarity with national waterway development, the corps is preeminently fitted to forecast and execute such waterway improvements as will be needed for the future. They are a *corps d'elite*, aloof from politics and inaccessible to influence. Their yardstick is merit.

DURWARD H. PRIMROSE,
Editor & Publisher,
Marine Journal
New York

Sewage Treatment Costs

Sir: In an article by E. B. Besselievre on p. 89 of the June 14, 1945 issue of *Engineering News-Record*, costs of sewage treatment at approximately 30 plants are listed. Included in the tabulation are data on the Minneapolis-St. Paul plant. This letter is written to correct an error relative to costs at that plant. Mr. Besselievre lists a cost of $9.90 per million gallons there, whereas the highest actual cost of operation and maintenance per million gallon was $7.98 in 1932 and the average costs for the seven-year period are approximately $7.25. Using the actual cost of $7.05 per million gallon for the year 1944 and the removals effected during that year, the cost per unit of B.O.D. removal at this plant was $1.21 and the cost per unit of suspended solids removed was $0.41.

I cannot explain where Mr. Besselievre secured the value of $9.90 unless he inadvertently used the budget estimate, which is likely to be considerably higher than actual costs since it includes an allowance for several months of chemical treatment which may or may not be necessary in any particular year. The removals Mr. Besselievre has presented are those accomplished without chemical treatment, and therefore it would be improper to present cost data on the basis of a higher degree of treatment than the basis on which the removals are calculated.

GEORGE J. SCHROEPFER
Chief Engineer & Sup't.
Minneapolis-St. Paul Sanitary District
St. Paul 1, Minn.

Seabee Pontoon Piers

Sir: I have read with great interest the article, "Seabee Pontoons Form Floating Piers" (*ENR* March 8, 1945, vol. p. 308), but note with some regret the fact that you did not identify by name any of the Seabee personnel connected with these operations. Comdr. F. J. Early, CEC, USNR, was on the staff of the Commander, U. S. Naval Ports and Bases, France; Comdr. V. W. Buhr, CEC, USNR, was in command of the 25th Construction Regiment; Comdr. E. H. Gessner, CEC USNR, was in command of the 114th Battalion, and Lt. Comdr. J. H. Kopp, CEC, USNR, was in command of the 28th Battalion, the units directly connected with this work.

I think the statement appearing in the last sentence on p. 97 of the article, as follows: "This same grade (10 percent) continues over the Bailey bridges at low tide when their outer ends are down, decreasing as the tide rises until, at high tide, the Baileys are horizontal", is incorrect and should read: "This same grade continues over the Bailey bridges at low tide when their outer ends are down, decreasing to horizontal as the tide rises until, at high tide, the Baileys have a 10 percent grade in the opposite direction." I am assuming that the tidal range was about 26 ft. and that the Bailey was 130 ft. long at the installation described.

J. J. MANNING, R.ADM. (CEC) USN
Director, Atlantic Division
Bureau of Yards and Docks

(For the dimensions and tidal range cited, Admiral Manning is, of course, correct; the Bailey would not be horizontal but would slope upward from the shore at high tide.—Editor)

EDITORIALS

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ENGINEERING NEWS-RECORD is a consolidation of Engineering News and Engineering Record, effected in 1917. The Contractor was consolidated with Engineering News-Record in 1918. Engineering News was founded in 1874 as The Engineer and Surveyor, which title subsequently became The Engineer, Architect and Surveyor, Engineering News and American Railway Journal and finally Engineering News. Engineering Record was established in 1877 as The Plumber and Sanitary Engineer. Subsequently it became The Sanitary Engineer, Engineering and Building Record, and, finally, Engineering Record. All rights to the above titles are reserved.

Pavements for Big Planes

CONCRETE SLABS of unprecedented thickness, designed to accommodate planes two-and-a-half times as heavy as the 70-ton Superfort, are being experimented with on military airfields without, up to now, much publicity or opportunity for professional discussion. An article in this issue, therefore, on some 18-in. slabs at Moffett Field in California is important, although its significance rests more on the questions that it raises than on those it answers. One of the basic questions is the relation between types and thickness of surfacing and compacted subgrade depth. Then, where thick concrete slabs are used, as at Moffett Field, there are questions concerning the type and strength of concrete, amount and disposition of reinforcement, methods of placement and curing procedures. Whatever materials are used, the potential investment in postwar airport paving is so large that all possible guesswork should be taken out of its design and construction. To this end, government agencies should remove all unnecessary security restrictions from their present research, and civilian engineers and equipment and material interests should lend all possible support to an enlarged program of study. Planes should not be allowed to continue to outgrow their pavements.

Negotiated Contracts

THOSE who were both puzzled and somewhat alarmed by the announced intention of the Corps of Engineers to substitute privately negotiated contracts for publicly opened bids should be reassured by General Reybold's explicit statements (*ENR* June 21 and 28, vol. pp. 861 and 875). The Chief of Engineers points out that the War Department is required by the WPB to negotiate all war procurement contracts, and that since at present civil works are only undertaken as a part of the war effort they come under this ruling. The fact that some Engineer Districts had not followed the ruling on civil works contracts and were ordered to alter their practice to accord with official policy induced the confusion that should now be dissipated. Henceforth, until the end of the Japanese war, the Corps of Engineers will use negotiated contracts, but in General Reybold's words will then "revert to the peacetime policy of public advertising and the awarding of contracts to the lowest bidder at public bid openings." That would be in keeping with past practices of the Corps, which held to public lettings long after they could have been abandoned in the early days of the war. And it is to be hoped that the Corps' belief in the basic soundness of public bidding will result in a request that the WPB modify its ruling before the end of hostilities should conditions improve to the extent that river, harbor, and flood-control work, in no way connected with the war, can be undertaken by peacetime methods.

Unexplored Equipment Market

EQUIPMENT to facilitate mosquito control operations has not received the attention it deserves. In almost every case where such operations have been undertaken, "home-made" rigs are devised or, lacking either original or borrowed ideas, the work is done as best it can with standard tools. When the Tennessee Valley Authority found that its mosquito-control program called for special equipment its engineers developed and built, among other things, a timber rake that is said to have "revolutionized" clearing methods on flat land. This rake, which is attached to the bulldozer blade on a tractor, is described on p. 108 of this issue. But the TVA brainpower and facilities that provided this machine are not available to every county or district mosquito-control agency. Consequently the latter have to depend on progressive equipment manufacturers for such a machine. Again, in the matter of special equipment, there is a good possibility that if someone developed a machine for the application of bituminous lining to control ditches there would be a broad market for the machine as well as the bituminous lining materials. Mosquito-control work, which promises to command the widest attention in the postwar period both in this country and Latin America, deserves the study of equipment manufacturers. Inefficient hand-labor construction methods would be quickly abandoned if the proper machines were made available to those who do the field work.

National Policies on Construction

REALISTIC and laudable points of view relating to a national construction program were enunciated in the Vinson and Colmer reports, which were issued independently on July 1 (*ENR* July 5, pp. 1 and 2). Since Mr. Vinson speaks as Director of War Mobilization and Reconversion and the Colmer report reflects the thinking of the Special Committee on Postwar Economic Policy and Planning of the House, the construction industry may find assurance that their statements will weigh heavily in the determination of national postwar policy.

It is particularly satisfying, for example, that the Congressional committee should cite as the first principle for a "healthy" national program the abolishment of any ideas that federal aid might be made available for the construction of purely local public works. A declaration of this kind is long overdue, not the least evidence of which was the comment of New York City's mayor when he recently received federal funds for designing a new market; he made it plain that federal money for construction was expected next. Too many mayors and other responsible authorities are expecting the same thing in regard to local improvements, and if this attitude can be dispelled, postwar planning, among other things, will be much more soundly advanced.

Another principle advocated by the Colmer committee—the establishment of a construction policy board in the executive office of the President to guide public works programs—is also to be commended. It revives the idea of an overall planning authority, which had its initial trial in the now defunct National Resources Board. Had the latter confined itself to the practical task of coordinating planning instead of acting too much in the role of a propaganda agency for social uplift, it might now be available to discharge the function for which the new body is proposed. Certainly there exists the need for central direction of federal public works policies, a fact that was made apparent most recently in the conflict of plans laid before Congress by the Corps of Engineers and the Bureau of Reclamation for the Missouri River development.

Both the Vinson and the Colmer reports are in common agreement that public works construction should not be permitted to "compete" with private building during the reconversion period. In this they express clear recognition of the probability that the construction industry will soon be faced with demands far beyond its immediate capacity to produce and that, in order to give the industry time to tool-up for maximum performance, public-works projects are the logical ones to be held in abeyance. In so doing, there is the added gain of providing a backlog of work from which the industry would derive stability for consistent and high output.

All in all, the two reports represent a sound appraisal of the problems ahead, and they provide good counsel to follow. If leadership of this kind can find expression in national policy formation, the construction industry will find it easier to achieve the high goals that have been established for the postwar period.

Illinois' New License Law

MUCH CREDIT is due the Illinois Engineering Council for the sound manner in which it handled the task of rewriting the state's general engineer license law after that law had been declared unconstitutional by the Illinois Supreme Court. Bearing in mind the weaknesses of the old law to which the court took exception, the drafters of the new document threw precedent aside. In so doing they completely abandoned the all-inclusive model-law definition of a professional engineer, substituting therefor a statement that a person practices professional engineering within the meaning of the act who plans or designs the physical parts of 31 specified types of engineering work. This plan represents a promising way to make clear and definite just what a professional engineer is insofar as the right to practice is concerned. Precedent also was abandoned in setting educational requirements. As specified, they embrace the subjects required for a baccalaureate degree at the University of Illinois, thus limiting the freedom generally granted to licensing boards.

Minor defects can be found in the law, and it appears obvious that some elements will be severely criticized by those who hold that an engineer license law should cover all the work that engineers do. Nevertheless, the Illinois Engineering Council acted wisely in sending to the legislature a law that so obviously meets the Supreme Court's objections. Any need for changes that develops subsequently can be met by amendment.

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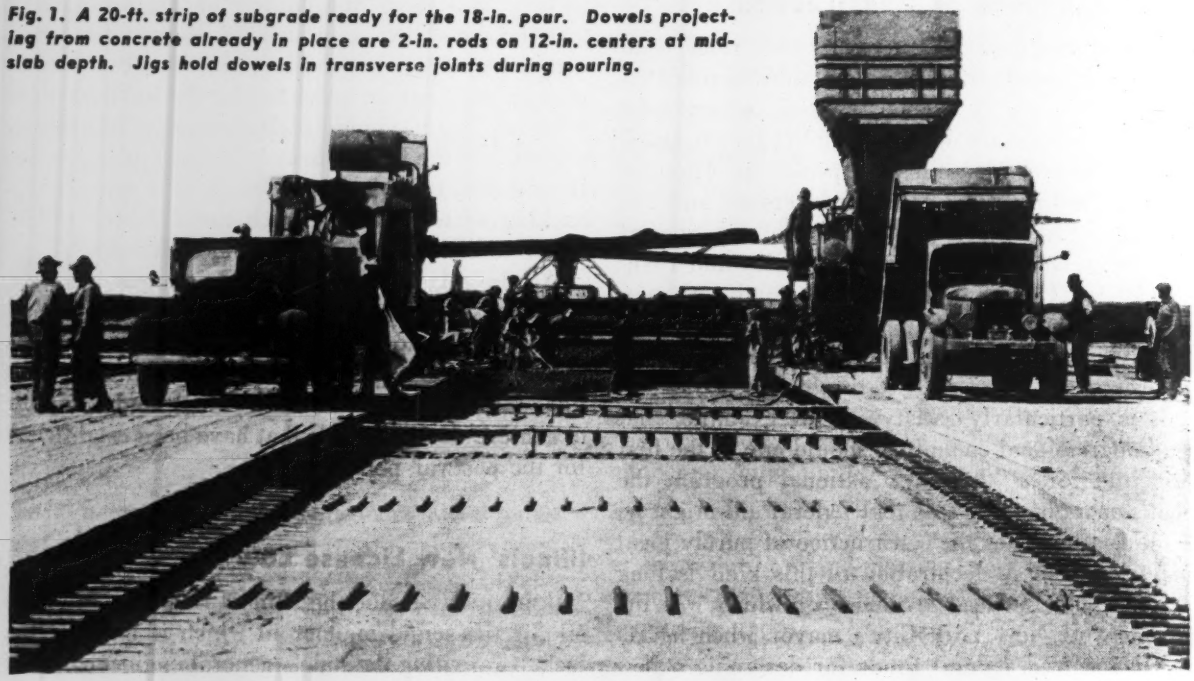


Fig. 1. A 20-ft. strip of subgrade ready for the 18-in. pour. Dowels projecting from concrete already in place are 2-in. rods on 12-in. centers at mid-slab depth. Jigs hold dowels in transverse joints during pouring.

Paving for the Biggest Planes in Sight

***Contents in Brief**—An 18 in. concrete slab is provided to sustain concentrated wheel loads of 175,000 lb. (half of the total for a 175-ton plane) on the warming-up aprons and floor of a new hangar at Moffett Field, Calif. The paving is on a well-compacted base of 24 in. thickness. Dowels 2 in. in diameter on 12-in. centers are used across joints between slabs, and special care was given to the surface finish of the pavement.*

PAVEMENTS DESIGNED FOR loads greater than any heretofore experienced on airfields have been laid on the warming-up apron and in a hangar built at Moffett Field, Calif. for the Ames Laboratory of the National Advisory Committee for Aeronautics. Slab thicknesses range from 9 to 18 in., the latter being used for those parts of the apron and hangar floor where planes are to be rolled. This was done because it is believed that vibration incidental to warming up and particularly to "revving up" the motors while a plane is standing puts a more severe load on the pavement than would occur on a runway in normal landings or take-offs. All slabs are supported on a well compacted fill 24 in. thick.

At the hangar where this paving was laid the soil was rated as a "heavy black humic alluvial clay with a very low bearing value." It is subjected to severe swelling on absorption of moisture and when moist is quite plastic and inclined to flow. The factor k in Westergaard's formula as applied to this soil has been rated at only about 30. Tests of this foundation material gave erratic and widely varied results. For example, concrete sidewalks laid on this soil with and without sand cushions and on dry ground as well as when the ground was saturated, as in the rainy season, were in nowise consistent. There appeared to be no regularity or reliability in the rate of swelling, heaving or shrinking action that could be expected.

Despite the low bearing value of the foundation, it was desired to lay paving adequate for loadings imposed by the largest airplanes presently proposed, including recently announced giant passenger liners estimated to weight about 175 tons, of which half, or 175,000 lb., would be concentrated on each of two wheel-groupings. This load, it was found, would exceed that imposed by the hangar structure itself despite the concentrations resulting from 260-ft. span roof trusses on a 40-ft. spacing.

An 18-in. concrete pavement

To meet the requirements imposed by airplane wheel loads on that portion of the hangar floor and warming-up apron where the plane will be rolled, it was decided that the foundation requirement would be a 24-in. thickness of firmly compacted subgrade put down in four 6-in. layers of imported fill. Over this would be placed an 18-in. slab of concrete with a specified strength at 28 days of not less than 4,000 psi. The reinforcing of the slab would be only such as should be provided to take care of temperature stresses, but in the con-

traction joints between adjacent edges of the 20-ft. slabs in which the concrete pavement was placed it was thought desirable to use steel to distribute the vertical shear at the joint. Accordingly steel rounds 2 in. in diameter have been placed on 12-in. centers. They are 36 in. long, projecting 18 in. into each of the adjacent slabs.

In addition to the 18-in. paving, lesser thicknesses in adjacent areas are provided in accordance with expected loadings, namely, 12 in. and 9 in., respectively, forming one continuous slab.

Contraction joint dowels in paving of all three thicknesses are 3 ft. long and on 12-in. centers. The diameters vary, however; in the 12-in. pavement the dowel diameter is 1½ in. and in the 9-in. thickness, ¾ in. The reinforcing steel put in to take care of temperature stresses also varies. The mesh bars are ½ in. in diameter for the 12- and 18-in. slabs and ⅜ in. in diameter for the 9-in. slab and are placed about 2 in. below the surface on 12-in. centers both ways.

Header designed for easy removal

Special attention was given to the headers to make sure of adequate support for the 2-in. dowels and at the same time to provide for easy removal of the headers after the concrete had set. For the 18-in. slabs the headers were made up of two runs of 4x9-in. plank with the dowels placed along the centerline. For the 12-in. slabs 4x6-in. planks were used.

Dowels are held in place in the headers by passing them through holes made after the planks were fastened together with cleats. The holes were bored on 12-in. centers with the boring tool held so that half of the circle was cut in each timber. By using headers thus made of two pieces, when time came to remove them, the upper half could be lifted off and then the bottom edge of the lower half could be pulled horizontally away from the concrete, allowing the upper edge to drop down and away from the underside of the dowels.

In headers for the 9-in. paving, in which it was not thought necessary to go to the expense of boring holes, the same plan of making up headers out of two halves was used, but the halves were separated for the thickness of the dowel by a wood strip or filler tacked to the edge of one of the headers between dowel locations. This procedure left square holes for the round dowels but this was not found to be a disadvantage.

Placing concrete in thick slabs

The 18-in. paving was put down in a single pour with only slight modification of ordinary methods. The principal deviation was in the matter of vibration as something more than the usual provision for vibration was thought necessary. The program provided for a concrete paving mixer to advance along either side of the 20-ft. strip in which the pouring was in progress, delivering continuously throughout the run. Each 20-ft. strip was divided into square panels by dummy joints placed at 20-ft. centers.

Men with square-nosed shovels helped spread the concrete placed in layers by skips from the mixers. Two portable, bayonet-type vibrators, each driven by a gasoline engine, were used to spread and work the mix ahead of the finishing machine. These portable vibrators could be moved ahead by one man and could be worked in the lower portion of the thick slab. With this advance help from vibrators, the concrete was in a condition such that the standard mechanical vibrating machine could give it the necessary agitation.

Usually about five men were required for placing the steel dowels in the transverse contraction joints.

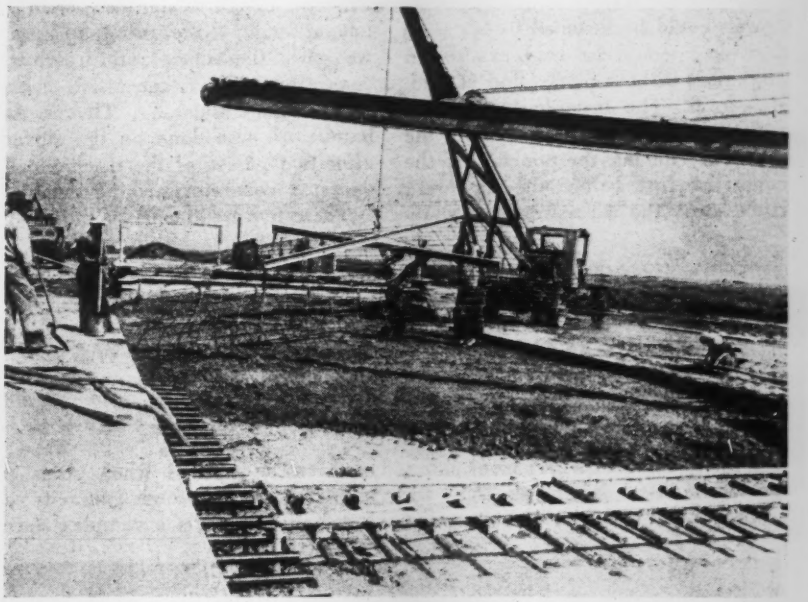


Fig. 2. A T-rail spreader is used in placing 20x20-ft. panels of temperature steel. Dowel jig in foreground holds bars in exact position at contraction joints.

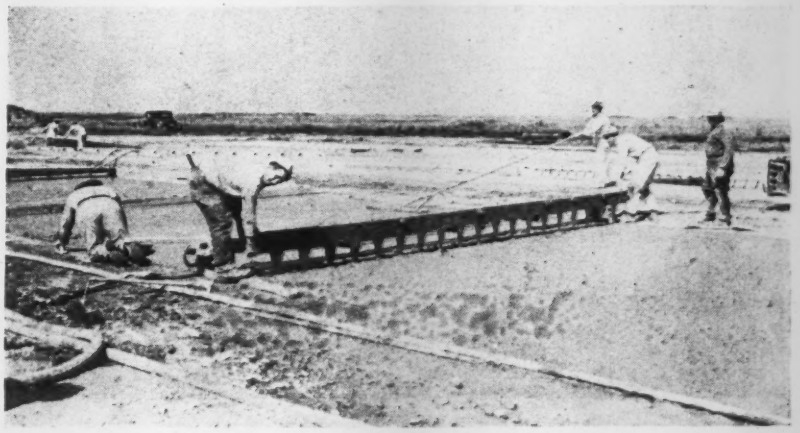


Fig. 3. Removing saw-tooth steel plate used to hold expansion joint filler in place.

which are on 20-ft. centers. For this purpose supports or jigs made up of welded pipe were used to hold the dowels in position while the concrete was being poured around them. After the concrete was all in place and before the mechanical finishing machine moved over the joints, this jig was lifted out and moved ahead, leaving the dowels in the concrete.

Method used to place dowels

The procedure was to lay the dowels on the subgrade ahead of concrete pouring, placing them in the proper position and at the desired spacing. Then a jig would be carried in by two men and set down on the subgrade over the row of dowels. The jig provided a support to which the dowels could be fastened by wires so that they would be held exactly in alignment in both planes and at mid-slab level. The fastening was made with light wire as it was to hold the rods only during the pouring of the concrete. Just before the jigs were lifted away the wires were cut to release the dowels, after which the jig could be lifted off without disturbing the dowels.

Another crew of five placed the expansion joints which were set at about 100-ft. intervals. A 6-in. length of tube with a cork in one end was placed over one end of each steel bar in the expansion joints. This was to make sure that the bar will have room for movement in one of the abutting slabs and thus will be free to slip. The cork, by its ability to compress, insures space for increase of bar length under temperature changes. One-half the length of each dowel was greased to prevent bonding and thus permit the bar to move in the concrete.

The surface of all the pavement, of whatever thickness and whether in the hangar or on the warming-up apron, was given the same careful treatment, consisting of five successive operations in hand finishing. That is, this handiwork was done on the surface after two passes of the mechanically operated concrete finishing machine.

These five treatments included (1) surfacing with the bull float, (2) one pass of a cutting screed, (3) second treatment with the bull float, (4) two passes of a hand belt finishing tool and, finally, (5) a broom finish to give the surface an antiskid quality.

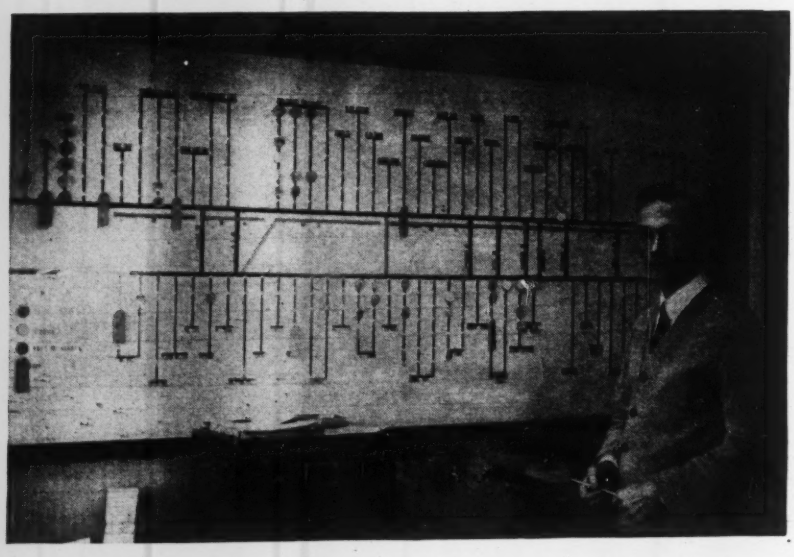
Pavement in the hangar was steel-troweled for a hard, smooth surface instead of receiving the broom finish. Before the pavement is used it is expected that colored lines painted on the suface will mark boundaries of the areas of different thicknesses, thus indicating the limits for certain prescribed loadings.

Water cured concrete pavement

In curing, the surface of the pavement for the 12- and 18-in. slabs was diked and ponded, this procedure being preferred to the use of a seal coating that served on the 9-in. slab. The water curing was used as an aid in dissipating the heat of setting. With a slab 18 in. thick containing as much cement as was here used (6.07 sacks per cu.yd.) it was felt that aid in heat dissipation might be an advantage.

Dispatcher's Wall Board Shows Equipment Location

With 18 miles of wharf front along the Willamette River, crossed by numerous bridges whose draw spans have to be opened when ships of any size pass through, the city of Portland, Ore., has a complex stevedoring problem. The Willamette Tug & Barge Co., in order to keep track of the considerable fleet of repair and unloading equipment which it operates on this waterfront, maintains a dispatcher's wall board, shown in the accompanying illustration, on which the location of each piece of equipment can be very easily seen by a glance at the colored markers hung on small hooks.



Portland's waterfront, in diagram, is tagged with a marker for each piece of equipment.

Colored tags mark job location

Large rectangular tags are used for ships, circular yellow tags for derricks, red tags for loaded barges and white tags for empty barges. Whenever a piece of equipment goes to work a tag is hung on the wall board where it marks the location until this job is done.

Work orders are written on a blank form that registers in triplicate; a white copy is for billing, a yellow one for the piece of equipment itself and a blue one for filing. This work order shows what piece of equipment is moved, where it goes and when. These records supplement, with detailed information, the over-all picture, which is shown by a glance at the board.

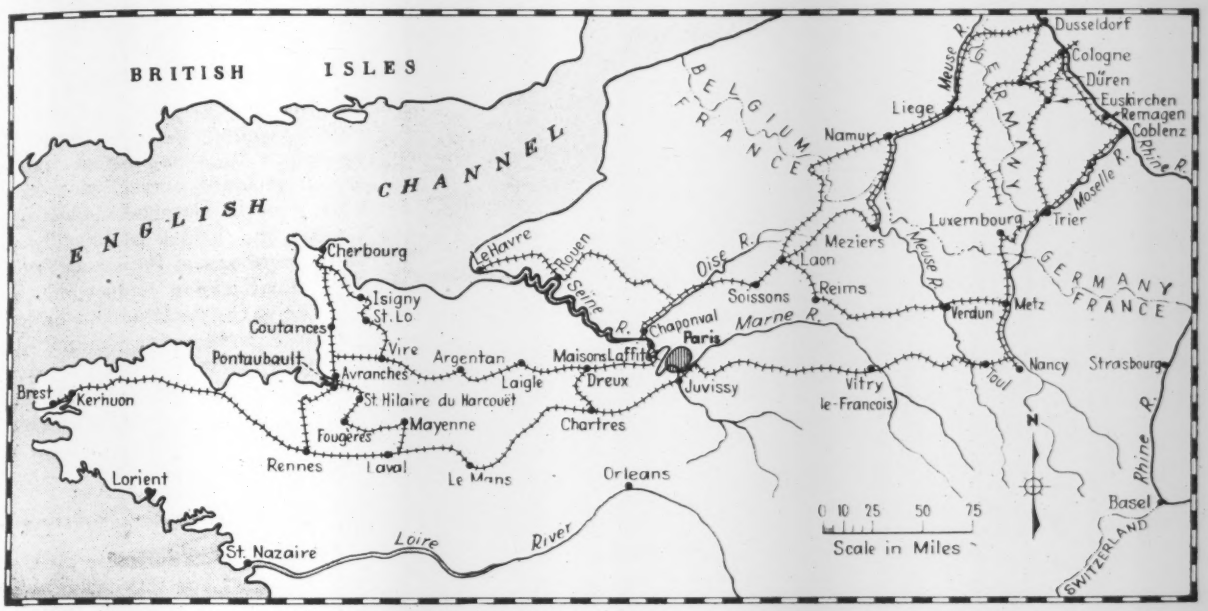


Fig. 1. Western Europe rail lines rehabilitated by U. S. bridging to serve as supply arteries from ports to the front.

Railroad Bridging in the E.T.O.

Waldo G. Bowman
Editor, Engineering News-Record

SHORTLY BEFORE the great Rhine offensive began Maj. Gen. Cecil R. Moore, chief engineer, European Theater of Operations announced that "The United States Army Engineers have rehabilitated 7,000 miles of European railroads to provide the Allied armies with major supply routes to the Western Front". How well these routes functioned is now evident from the successful results achieved.

The engineering and construction task in restoring so many miles of railroad to service was, of course, largely one of bridging, plus the reconstruction of a number of important marshalling and transfer yards, for these were the focal points of damage, not only by the Germans, but by our own bombers as well. As a matter of fact, the greater part of the damage in the West—Normandy and the western part of the Paris Basin south to the Loire River—was done by Allied bombers. As we moved east of Paris up toward the German border and on to the Rhine, German demolition damage exceeded bombing. But in either case it was the bridges that suffered, and it was they that had to be rebuilt before the supply lines could function.

It is all very well to be able to rush a great highway trucking system into being, as we did from Normandy to Paris and beyond with the "Red Ball," the "White Ball" and the various other special routes, but it provides no permanent solution, and it is bound to break down sooner or later. Trucks, men and roads are not able to take the kind of punishment that day-and-night, high-speed operation calls for. Only the railroads, with their steel tires, steel roadways and equipment that can be run with a minimum of fatigue by their crews, can meet the supply need.

So it was that one of the great responsibilities of the Engineers was to get the railroads running as soon as possible, and that meant bridges. A review of the tactical situation will be helpful in understanding the significance of the bridges, and in singling out those that were particularly vital, being the bottlenecks or the keys to success depending on how fast they were built.

Fig. 2. Repairs to bridge at Pontaubault illustrates use of the "official standard" military railroad bridge items—UCRB (Unit Construction Railroad Bridge) truss spans and LST (Light Steel Trestling) piers.

As our armies started to spread out across the Normandy peninsula about the time of the fall of Cherbourg, the first rail lines that became important were from the port of Cherbourg to the front as it advanced south toward Brittany. Then came the break-through, and the rail requirements were all the way to Paris. This was by way of Avranches, Rennes, Laval, Le Mans, and Chartres. (See map, Fig. 1) But the Laval bridge, a high stone arch, was out, and would require some time to rebuild.

Accordingly, a bypass route on a single-track line, which the Germans had not thought we could use, was opened. It ran from Avranches to Fougeres to Mayenne, and thence into the main line east of Laval. This was the line that five Engineer General Service Regiments put into running order in 48 hours, including the reconstruction of the bridge at St. Hilaire du Harcouët.

Juvissy bridge vital to offensive

With this line in, the Engineers went back and repaired the bridges at Coutances, Pontaubault and Laval, so that a double-track line would be available as soon as possible. Other bridges on this line all the way into Paris were easily fixed. But there was needed a Seine River crossing south of the city so as to bypass its yards. The bridge at Juvissy, therefore, became a key structure in carrying the railroad east of Paris to supply General Patton in front of Metz where he had to halt his drive toward Berlin until gasoline and other supplies could catch up with him.

In the meantime, it was evident that a shorter line from the Normandy ports was available from Vire, through Argentan, Laigle and Dreux. Bridges at all of these points, as well as at others, were out, but the controlling structure was a long high viaduct at Dreux.

East of Paris, the first routes developed were very circuitous, following paths of least construction resistance. In the meantime, however, work could be proceeding on the bridges on better routes. Two important early structures were at Maisons Laffite and Chaponval, northwest of Paris, which opened up a line that bypassed the inner railroad loop of the city for trains going northeast through Soissons and Laon to Namur and Liege, or from Laon to Reims, Verdun and Metz. Important bridges to be rebuilt on these lines were at Verdun, Metz and Meziers, and at Liege, where there were two, known as the Renory and Ile Monsin bridges.

Straight east of Paris, and reached via the bridge at Juvissy, the best line developed ran through Vitry-le-Francois, where an interesting bridging job was necessary, to Toul and Nancy, from where a line was opened north through Metz and Thionville to Luxembourg and on to Liege. All of these cities, except Luxembourg, were the scene of emergency bridge construction jobs, Thionville having two, while between Nancy and Toul six crossings of the Meuse River had to be rebuilt. This north-south line, incidentally, as well as branches from it, was overrun in the German counter-attack of December and January, giving rise to another bridge building program, which was described in *Engineering News-Record* May 17, 1945, vol. p. 696).

After the lines necessary to serve all vital areas had been opened up, it was possible to come back and fix up some of the badly wrecked structures that had to be bypassed in the first construction phase, and whose opening to traffic improved operations in a number of specific areas. Included among such structures were the Darnetal viaduct near Rouen; the bridge at Neuilly-sur-Marne northeast of Paris and, farther afield, the Kerhuon viaduct on a line into Brest. On the latter two bridges, American participation was limited to supplying materials and some equipment to the French National Railways, a procedure that was widely followed on all later bridges after the emergency rush was over.

Bridges and bridging materials

Two basic facts influence the character of all of our railroad bridging in Europe (over and above the fact that it is designed for liveloads equivalent to something over E-40.) namely the use of British-designed, prefabricated trusses and trestle framing and, in lieu of the trusses, of wide-flange rolled-girder sections, first obtained from captured German stocks, but later manufactured to our order by a mill in Luxembourg. Of nominal 40-in. depth, but actually a meter or 39.37 in. deep, and consequently called "meter beams", these girders have no counterparts among either British or American rolling mill products.

Flanges of the meter beams are 11.81 in. wide and 1.42 in. thick, while the web thickness is 0.75 in. The beams weigh 210 lb. per ft. and have a section modulus of 787 in.^{3} The practice is to use two such beams, one under each rail, for spans up to 55 ft; three beams, with one on the centerline, for spans of 60 and 65 ft; four beams, two under each rail, for 70 and 75-ft. spans; five beams, one being on the centerline, for 80 and 85-ft. spans; and six beams, three under each rail, for 90 and 95-ft. spans. The beams are rolled to a maximum length of 95 ft.

But while our operations have leaned heavily on the use of meter-

beams, it was the British bridging that formed the basis of our continental railroad planning and which, in fact, we have used extensively. The principal items included are the Unit Construction Railroad Bridge, known as a UCRB, a parallel-chord, Pratt-type truss span; Light Steel Trestling (LST) and Heavy Steel Trestling (HST), which are two weights of prefabricated columns (in 3, 4, 8 and 12 ft. lengths) and bracing members that can readily be assembled into tower piers of various heights and plan dimensions; and Rolled Steel Joist spans (RSJ's), which are merely girders made of two or three I-beams welded together side by side. Two other bridges, a 40-ft. span sectional plate girder and a 150-ft. lattice truss span, were originally intended to be available, but were seldom if ever used.

Features of UCRB and LST units

The UCRB spans and the LST tower piers have proved their worth many times. There are numerous special procedures for their use, some of which will be brought out in the individual descriptions that follow so that only a few general facts need be pointed out here. For example, assembly is by bolting in both bridge and trestling, and the column joints in the trestling are flanged to facilitate making the bolted connections. Both the LST and UCRB break down into individual pieces light enough to be lifted manually or by small hand hoists. The UCRB may be installed as either a through or a deck span, either two or four 6-ft. 10-in. deep trusses being used if the former, depending upon the span, and either two or three such trusses being used for the deck structures. Floor-beams are 30-in. rolled sections. The spans are designed for back-of-the-abutment assembly and installation by cantilevering, aided by a special, light launching nose, which reaches the far support first and thus helps to carry some of the weight.

Obviously, such special bridging can only be installed with maximum speed and efficiency by crews familiar with its details and erection procedures. For this reason a school was established in Derbyshire, England prior to the invasion at which three companies from each of two Engineer General Service Regiments, the 332nd and the 347th, received extended instruction in assembly and launching methods. The head of the school, Lt. Col. A. R. Wellwood, who is now with the 347th, and his chief instructor, Capt. H. E. Read, now in Lt. Col. Robert A. Radford's railroad section of the Chief Engineer's office, both attended the regular British bridging school prior to the establishment of ours. With this nucleus of trained specialists, others have been developed on the continent so that there is now no dearth of experienced personnel to build either the UCRB or the meter beam spans, which are also launched and often are supported on LST towers.

"Know-how" in bridge building

Each bridge that has been built has some particular claim to fame, being spectacular in design or execution, or furnishing an example of ingenuity, the use of "know-how" or even of human bravery and sacrifice. By presenting the individual stories of as many of the more important ones as space will permit, it is hoped that some appreciation may be gained of the general character and the phenomenal success of the whole railroad bridging program in the European Theater of Operations.

Fittingly enough one of the early bridge reconstruction jobs occurred at St Lo, the Normandy town made famous by a great American victory. Here, two of the three 55-ft. masonry arch spans of a double track bridge were badly damaged by demolitions, one being gone completely with the exception of the ring of stones and a few brick in the face of one spandrel, while the other had a hole in the crown about 25 ft. long and 5 ft. or more wide under one track. None of the planned-for military bridging supplies yet being available, the Engineers of the 347th Engineer General Service Regiment had to do what they could with what they had or could find.

Timber solved the problem

No amount of ingenuity could avoid an entirely new span in the center opening where only a piece of the spandrel construction remained. The solution was a timber stringer deck supported by timber bents at the third points of the span. The bents were framed into a tower for rigidity, and the longitudinal horizontal members of the tower were extended the full length of the span to serve as struts, resisting the unbalanced thrust of the arches at either end. (Fig. 3.)

Since most of the other damaged span was standing, a repair job was indicated, although it promised to be difficult since a sizable chunk of the arch was gone. Rather than trying to span and brace the hole, it was decided to replace the masonry with concrete. The original construction consisted of stone arch rings in the

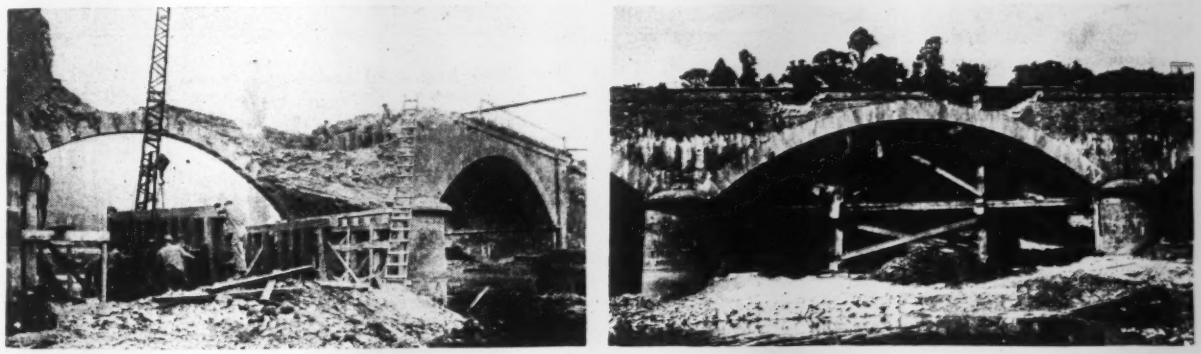


Fig. 3. Blown out masonry span at St. Lo is replaced by timber construction. Note that horizontal member of tower (right view) extends full length of span to resist thrust of adjacent arches.

Fig. 4. Another damaged span of the St. Lo bridge had its stone arch ring repaired by a new concrete section, the form for which is being lifted into place.

spandrel faces with a brick barrel arch between, so that the principal requirement was to insert a strong new section in the damaged arch ring, after which the remainder of the opening in the barrel could be closed with a concrete slab.

The framework of the new arch section was made up on the ground of pieces of railroad rails fashioned to fit the opening exactly. Enclosed in side and bottom forms it was then lifted into place (Fig. 4), and concrete deposited around it by a crawler-crane-operated bucket. The ring frame-work, 2 ft. 3 in. deep and 1 ft. 9 in. wide, had a railroad rail at each corner and vertical and horizontal bracing members of rails so that it was amply strong to take the arch loads. (Fig. 5.) After the ring was completed a form was built from it across the opening in the barrel, and a concrete slab poured to hold the spandrel fill upon which the track would be laid.

UCRB for high viaduct span

The first of a number of high stone viaducts with missing spans to be replaced was encountered at Coutances. It also presented the first opportunity to use one of the special military bridges, in this case a 50-ft. through-type UCRB, which was readily launched across the single 39-ft. arch opening, using the special launching nose. The procedure was to assemble the span, with nose attached, on wheel dollies on the track on the adjacent existing arch. Then, with cables from the nose to a tractor on the opposite side of the opening, (Fig. 6) the assembly was pulled across and landed on cribbing, since it was launched at a higher elevation than the bridge shoes. Last operation was to lower the span to the shoes with hand-operated screw jacks.

This bridge also introduced the question as to whether or not it was necessary to insert horizontal struts between the piers of broken arches to take the thrust of the adjacent spans. With a flat arch and a slender pier, considerable unbalanced thrust could readily exist, it was admitted, but many of the arches of continental masonry bridges are semi-circular, and the piers are thick enough to act as abutments. Most of the time, however, it was decided to err on the side of safety and insert the struts, and this was the case at Coutances where it was easy to imagine the 70-ft. high piers moving toward one another under the liveload of a big locomotive in one of the adjacent arch spans.

The strut, which was installed, consisted of four 12x12-in. timbers of full span length assembled into a framed box 6 ft. deep and 4 ft. wide; it was butted against transverse timbers that straddled a corbel at the springline. Hoist lines attached to the UCRB were used to lift the strut into place. The Coutances bridge was repaired by the 347th Engineer General Service Regiment between Aug. 9 and Aug. 12, 1944.

Raising a "down-ended" truss

One of the great Engineer achievements of the war was the 48-hr. job that was done in opening the 75-mile single track line from Avranches to east of Laval, so that General Patton's forces could get supplies pending completion of big bridges at Pontaubault and Laval on the main line. A total of five Engineer general service regiments, upwards of 6,000 men, put the track back on fill, reopened three railroad yards, built new water tanks and repaired seven bridges. The largest of these

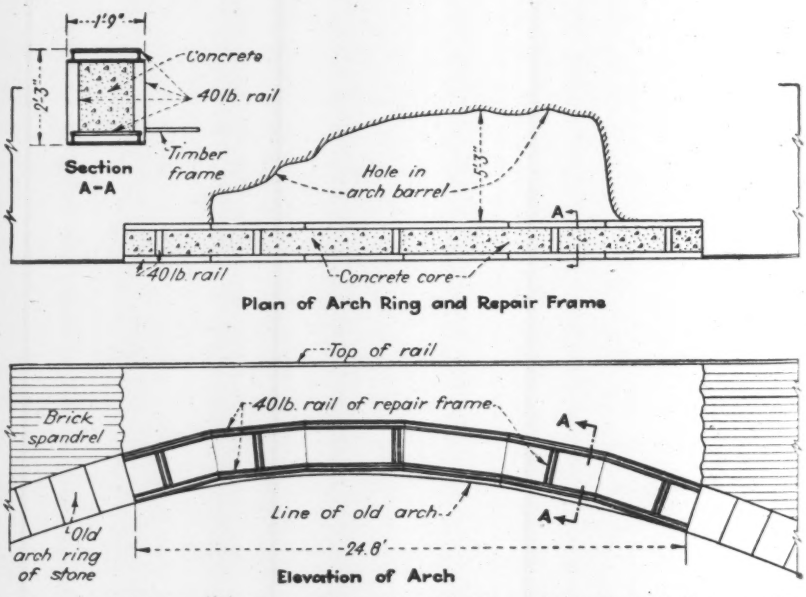


Fig. 5. Details of arch ring repair on St. Lo bridge, which involved the use of a new section composed of steel rails encased in concrete.

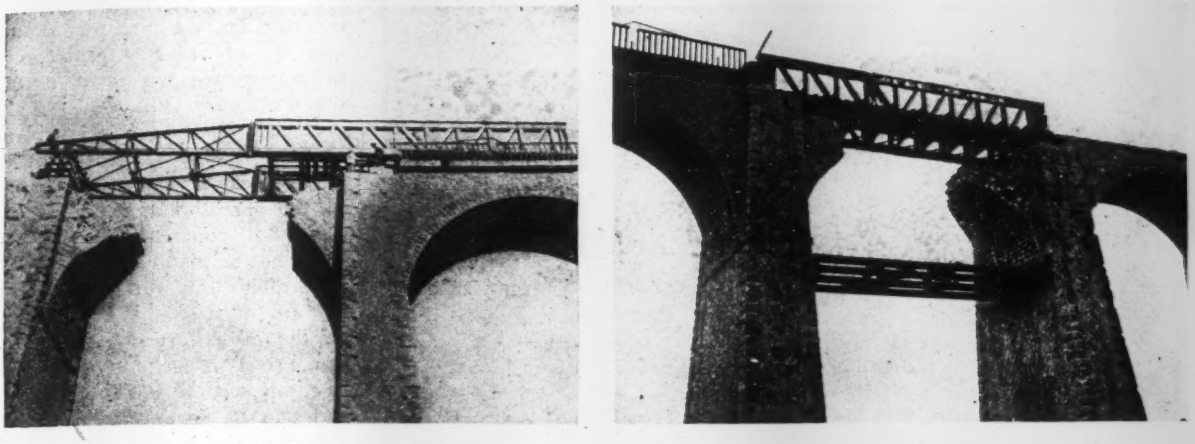


Fig. 6. Launching a 50-ft. through-type UCRB span across an opening in the high viaduct at Coutances with the aid of a temporary launching nose (left). After the span was lowered into position (right) a timber strut was installed below to resist any live-load thrusts from the adjacent arches.

bridges, that at St. Hilaire du Harcouët, over the Selune River, was a 110-ft., 100-ton truss span, one end of which was on the bottom of the river, 15 ft. below the bridge seat and 3 ft. out of line. Getting this structure back into service promised to be the bottleneck of the whole operation and, as a hedge against failure, turn-out fills were made and enough fill material stock-piled at the river's edge to carry the embankment across, if need be. In the meantime, however, men of the 347th Engineer General Service Regiment went ahead with the bridge job, and after many close calls saw success attend their efforts.

The job was essentially one of jacking, but complicated by the fact that the jacking crib had to be built in the water, and without benefit of a dry cofferdam, since there were no pumps available. However, a sandbag cofferdam was installed to give some protection against the current and, within this crib, construction began by piling rafts of ties, one on top of the other, until the lower one came to rest on the bottom and the others ceased to float. It was then possible to start jacking and building up the crib as a permanent support.

First operation was to level the span that had twisted in falling so that one side was 4 ft. below the other. Then followed the raising to horizontal position by two 35-ton screw jacks. And as the span approached a level state, 20-ton traversing jacks were brought into play, pushing it into alignment. A short fill at the end and a track connection then placed the bridge in service. Some 1,500 timber ties were required in the jacking crib, and their supply was no ordinary feat in itself. It was accomplished by men scouring the countryside with authority to buy all the timbers they could get, with high priority transport to the site ordered by the commanding general.

A through-type UCRB

The UCRB truss spans are ordinarily installed as deck structures because the full depth sway bracing gives them greater rigidity during launching than is possible with a through-type bridge; and because it is usually less work to lower a deck bridge from the launched position than it is to build up the old piers to reach the shoes of a through bridge, which would conceivably be launched at or near its final elevation. Despite these disadvantages of the through-type UCRB, one span of it was used at Coutances (Fig. 6) and two spans at Pontaubault, just south of Avranches. In one case the span was so short that the flexibility disadvantages did not apply while at Pontaubault a through-type was necessary in order to fit the new construction to the existing bridge. (Fig. 2).

The original Pontaubault bridge consisted of two separate, single track, three-span (138-164-138 ft.) through lattice-truss structures on common foundations about 40 ft. above the level of the Selune River. Allied bombers damaged one of the bridges beyond repair, and on the other wrecked the north end span and shifted the rest of the bridge sideways—3 ft. west at the north pier, 8 in. west at the south pier and 14 in. east at the south abutment. Both chords were wrinkled and bent, shrapnel had taken out a number of the web lattices, and a 500-lb. unexploded bomb had cut several top bracing members and was lodged in the floor system. A major repair job was indicated.

It was decided to replace the 138-ft. north span with two 70-ft. UCRB's resting on a 72-ft. LST (light steel trestling) tower of 2x4 type, *i. e.*, 2 panels long and 4 panels wide (Fig. 7) but although the preliminary work on this span could get under way immediately, first necessity was to get the rest of the bridge repaired and moved back into line and onto its shoes. Over 900 lb. of welding rod was required to fill shrapnel holes and attach patches. Moving the 200-ton bridge was accomplished by raising it with five 100-ton hydraulic jacks and then moving it sideways with four 32-ton traversing jacks.

The foundation for the LST pier had to be on piles, and twenty-eight of 50-ft. length had to be driven 40 ft. before the required bearing was obtained. They were then braced above ground, capped with 12x12's, and the whole decked over with 8x 12's as a base for the LST, which was erected by a 30-ton crawler crane with a 40-ft. boom.

The UCRB's were assembled on the approach fill, together with a 62-ft. launching nose, and pulled across the opening and into the end of the existing truss, with 4½-in. clearance on

Fig. 7. At Pontaubault two 70-ft. through-type UCRB spans were launched across an LST pier into the undamaged part of the original bridge. See also Fig. 2.

each side; the bearing for the UCRB was, of course, on the pier and not on the truss. A 4-ton winch on a truck, operating through a 3-2 tackle of ¾-in. captured German cable, supplied the launching power.

In addition to the crawler crane and the winch truck, the 332nd Engineer General Service Regiment, which built Pontaubault, used one heavy, and two lighter crawler tractors, a truck-mounted crane, and welding and cutting equipment. A total of 120 cylinders of oxygen and 40 of acetylene were required to cut up the old steel for removal.

Building the highest UCRB

Simultaneous with the construction of the Pontaubault bridge (Aug. 9 to Aug. 29) the one at Laval over the Mayenne River was also being pushed with all speed by the 332nd regiment, and was completed between the dates of Aug. 18 and Sept. 4. It, too, utilized two UCRB spans on an LST tower, but the spans were shorter, 50 ft., and the tower, 40 ft. high, resting on the old pier as a base, supported the track at a much higher level, 90 ft.

Although the height of the structure added some difficulties to the job, construction did not depart appreciably from standard. Early in the war the Germans had repaired the same two-span gap in the ten-span masonry viaduct with 90-ft. meter beams, but were able to use the central pier as a support, bracing it against the other arches and providing for transfer of their thrust through heavy timber struts placed at the springline. When we knocked out this construction, the pier was shattered and one of our first problems was to remove the top of it down to sound masonry (Fig. 8).

It had been proposed to launch a Bailey bridge across the opening to be used as a working platform for this operation as well as for pouring a 3-ft. concrete pier cap, but it could not be made available in time. Accordingly this work was done with the aid of a 30-ton crawler crane on the ground, which also set the first two 12-ft sections of the tower. The top section was out of reach, and had to be assembled in place, piece by piece.

The UCRB spans were assembled on the viaduct, together with a launching nose, and pulled across the opening by the winch line of a truck, which was mounted on a flat car so that it could be moved on the railroad track. Two double blocks were installed between the winch and the nose so as to cut down the speed of launching and, as a further safety measure, a tail anchor line from another truck winch was used. After the UCRB's were launched, they had to be lowered to the bridge seats, and this proved to be a tedious operation at the ends where there was a minimum of working space on the pier tops.

Setting UCRB's with barge cranes

Back in August, 1944, every railroad bridge job seemed to be more urgent and significant than the last, which was of course the case with the first crossing of the Seine River, located at Juvissy south of Paris, for, until this bridge was in, military

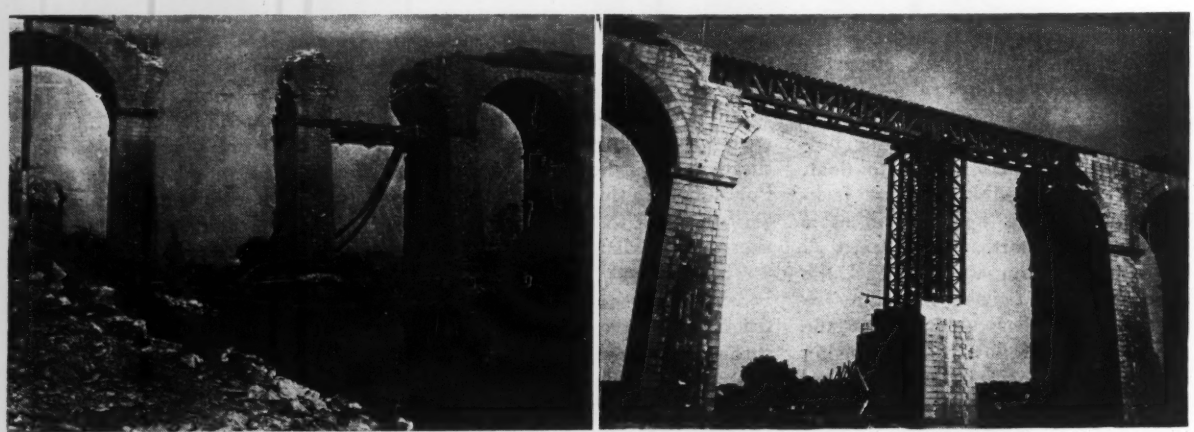


Fig. 8. Standard railroad bridging makes a neat repair job for two wrecked spans of the tall stone viaduct at Laval. The pier steel was placed by a crawler crane on the ground, and the trusses were launched.

operations east to Metz could not be supplied. Indicative of its importance is the fact that four 60-ft. UCRB spans and two LST piers were erected in the place of a twisted mass of steel wreckage in the period from Aug. 15 to Sept. 6, and the bridge placed in operation 48 hr. ahead of the schedule. One of the contributing factors to this speed, in the opinion of the officers of the 347th Engineer General Service Regiment, which built the bridge, was the fact that the spans and towers were preassembled on shore, and then placed complete by barge derricks.

The original Juvissy bridge consisted of two parallel double track structures, each containing five 116-ft. spans on 25-ft. high piers. The Germans had dropped the first (east) and the fourth spans into the river creating a rather formidable mass of wreckage, which had to be removed, in part at least, before new pier foundations could be built.

Our job was to build a single track bridge, but to make the LST piers wide enough for a second track. Speed being the only criterion, the piers were to be founded on "camels feet" (spuds that provide a considerable bearing surface on the river bottom), but only enough of these could be located for one installation. Accordingly, it was necessary to plan for timber piles under the LST pier to be built in the original east span. This seemed destined to cause a delay because of the necessity for first removing the wreckage of the old steel span, one end of which still rested on the abutment, while the other end was on the river bottom.

A cutting and blasting job

However, the difficulty was circumvented by a carefully executed job of cutting and blasting. First, a hole was cut in the deck of the inclined span, so located and of such size, about 25 ft. square, that when the span was blasted loose from the abutment it would drop in such a position that the piles could be driven through the hole, and the LST pier set on them, Fig. 9. This was, in fact, what happened when an explosive charge broke the bridge at about the quarter point out from shore. The job was speedily handled because none of the cutting had to be done under water.

The most distinctive characteristic of the Juvissy construction, however, was the fact that its spans and towers were prefabricated on shore. This permitted superstructure work to proceed simultaneously with pile driving and site preparation. A 30-ton crawler crane was used to assemble the 60-ft. UCRB spans and the 25-ft. LST towers. Then a French derrick boat picked the units up, was pushed out to the site by tugs and set them in place in a matter of minutes (Fig. 10).

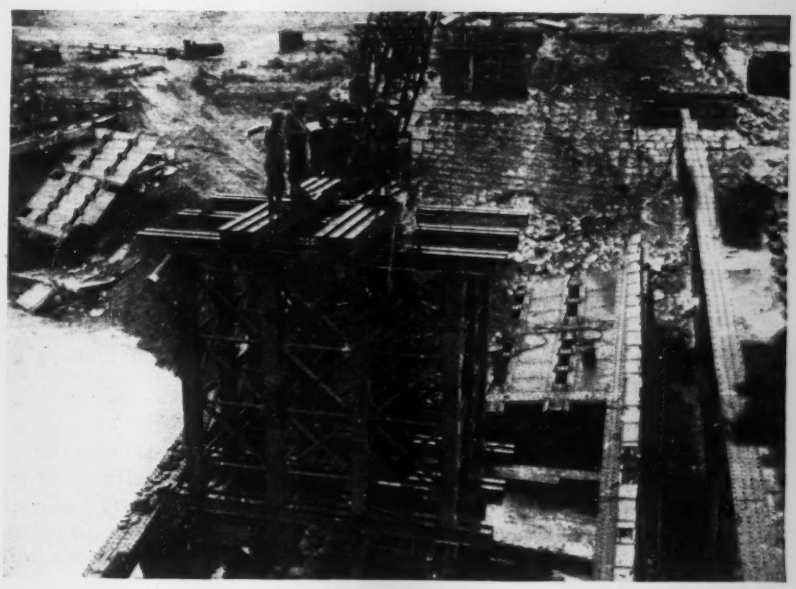


Fig. 9. Erecting an LST pier for the Juvissy bridge in a hole cut through the deck of the original structure.

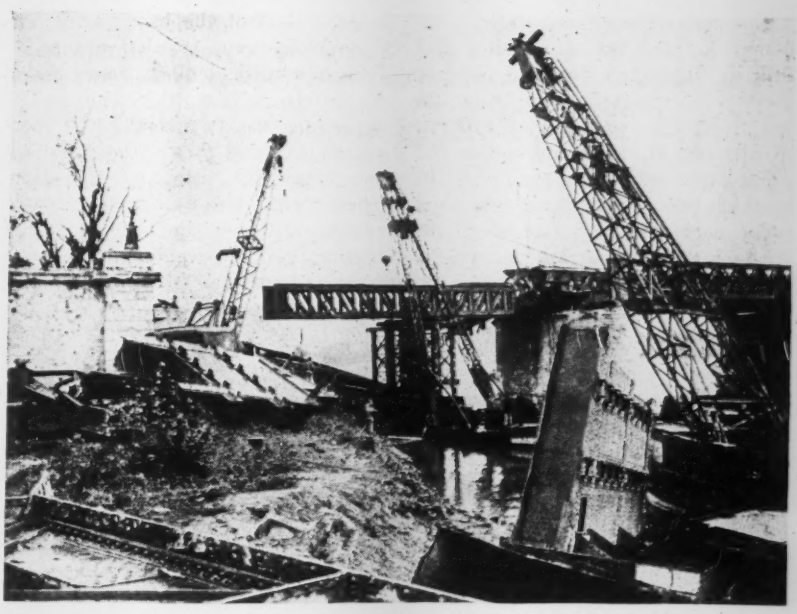


Fig. 10. A floating crane brings a completely assembled 60-ft. UCRB span from a nearby prefabricating yard to its position in the Juvissy bridge over the Seine River, a dozen miles south of Paris.

In the majority of long high masonry viaducts, the repair job was usually confined to a span or two, but an exception to this was encountered at Dreux, west of Paris, where complete destruction of the masonry arches across a 300-ft. opening occurred. This bridge, over the little Eure River, was a vital link in

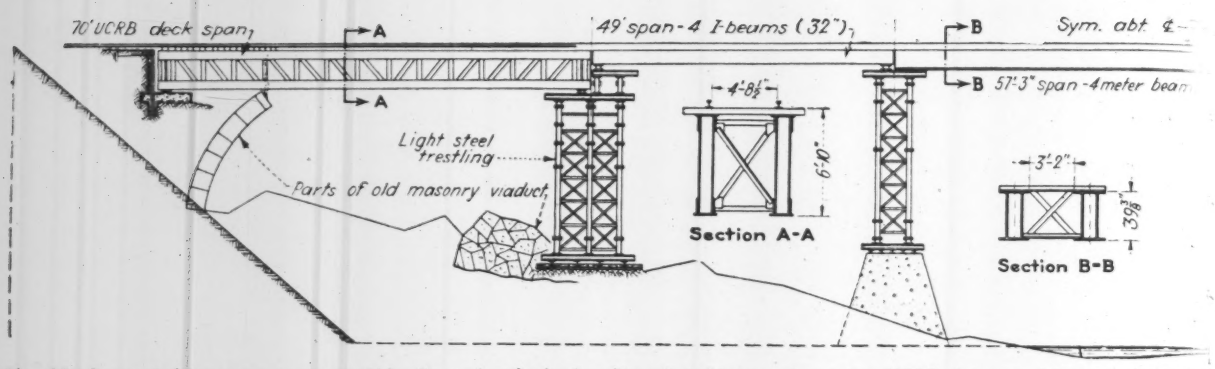


Fig. 11. Dreux bridge represents combination of principal railroad bridging elements—UCRB trusses, I-beams, including the 39.37-in. "meter beams", and LST piers.

the rail net, and we had, therefore, bombed the original bridge and then the meter beam spans that the Germans put in as replacements. So persistant was our bombing, as a matter of fact, that the local French residents finally blew the bridge up to stop the frequent visits of our planes.

The replacement structure, designed for the Dreux location and built by the 332nd Engineer General Service Regiment between Aug. 25 and Sept. 12, consisted of a 70-ft. UCRB span at either end and in the center three beam spans, two of 49 ft. in which two 32-in. beams were used under each rail and one of 57 ft. in which the construction under each rail consisted of two meter beams (Fig. 11). This superstructure, for a single track, was carried on four LST piers set on two existing concrete footings and on two new ones built over the debris of the masonry spans. The height of rail above the water was 52 ft.

All of the LST pier erection and a good deal of the other work was done with two crawler cranes, a 5-ton size with a 40-ft. boom and a 30-ton size with a 70-ft. boom. The procedure was to assemble the piers at one side and then to have the 30-ton crane lift them into position. There was also a truck-mounted crane, a heavy and light crawler tractor, two arc welding sets and a 7-S mixer in the equipment pool of the job.

The UCRB spans were launched in normal manner using a nose, and were landed on cribs built up on the LST piers. They were lowered from these cribs to the bridge seats on top of the piers by means of chain hoists suspended from head frames or gantrys temporarily set up on the LST framing as shown in one of the accompanying illustrations. This apparatus, a part of the standard erection equipment for UCRB spans, provides a much more rapid means for lowering than does jacking.

A distinctive characteristic of the Dreux bridge is that two of the I-beam spans, the 49-ft. span on the east and the 57-ft. center span, were also launched after being assembled on the approach track. An improvised I-beam nose was used on the 49-ft. span, while special connections were devised so that the UCRB nose could be attached to the 57-ft. span. Both spans were landed on cribbing and lowered by gantrys as were the UCRB's. The other 49-ft. span at the west end was assembled piece by piece in its final position by the 30-ton crawler crane working from the ground (Fig. 12).

Soon after the first track on the Dreux bridge was opened to traffic, it became apparent that a second track would be needed. This required that a duplicate superstructure be built and that the LST piers be increased 60 percent in width. For this job, the elements of all the spans, including the UCRB's, were assembled on the ground and lifted into place, since to have attempted to launch the spans necessarily would have required stopping railroad traffic on the other track.

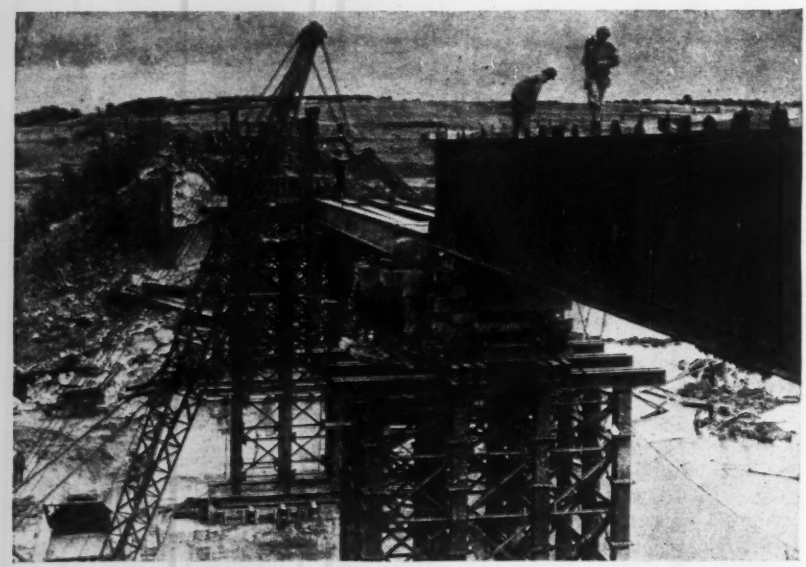


Fig. 12. Launching operations have just been completed on two spans of the tall LST-pier viaduct of UCRB trusses and meter beams at Dreux. The crane is removing gantry frames used to lower the beams from their launched position to the piers. When the bridge was double tracked later, the crane erected the new spans in lieu of launching.

Illinois Rewrites its License Law to Eliminate Unconstitutional Elements

***Contents in Brief** — Illinois' new Professional Engineering Act does not define professional engineering as did the law declared unconstitutional last year. Instead, it states explicitly just what constitutes the practice. It also clarifies the examination requirements for applicants and strengthens points declared weak in the old 1941 law.*

MOST SIGNIFICANT FEATURE of the professional engineers' license law recently approved by both houses of the Illinois legislature as a substitute for a law declared unconstitutional by the state's Supreme Court last year is abandonment of all attempt to define a professional engineer and substitution therefor of a statement as to what constitutes the practice of professional engineering under the law.

Practice defined

In declaring the old law unconstitutional, the Illinois Supreme Court directed most of its fire against the definition of a professional engineer (which had been taken verbatim from the so-called model law), characterizing it as "no definition at all" (*ENR* Dec. 28, 1944, vol. p. 346). The new law defines the practice of professional engineering to which the law is applicable as follows:

> A person practices professional engineering, within the meaning of this act, who plans or designs the physical parts of the following; railroads, railways, highways, subways, tunnels, canals, harbors, river improvements, docks and drydocks, levees and irrigation works; aircraft, airports and landing fields; waterworks, sewers and sewage disposal works; plants for the generation of power; engines or motors for the utilization of power; boilers; refrigeration and air conditioning plants; heating plants, plants for the transmission or distribution of power; electrical plants which produce, transmit, distribute or utilize electrical energy; works for the extraction of minerals from the earth; plants for the refining, alloying or treating of metal; chemical works and industrial plants involving the use of chemicals and chemical processes.

The new act is more streamlined and much more definite on certain controversial points than was the old one. One item worthy of special note is that the new law requires the licensing of only those engineers who *plan* or *design*. Supervision of construction is not included in the practice of engineering under the new law, as it was in the old, and the exemption relating to contractors is amplified to include inspectors in addition to superintendents and foremen.

Many exemptions

Services exempted from provisions of the new law are set forth in great detail. The act recognized that many of those exempted are commonly designated by the term "engineer", thus departing from tradition in the writing of engineer license laws. For example, among the exempted services are those "performed by those ordinarily designated as chief engineer of plant operation, chief operating engineer, locomotive, stationary, marine, power plant or hoisting and portable engineers, or electrical maintenance or service engineers or engineers employed in connection with . . . waterworks, steam, electric and sewage treatment and disposal plants . . ."

The practice of structural engineering as defined in the Illinois Structural Engineering Act and the practice of architecture as defined in the Illinois Architectural Act are exempted, but engineers registered under this new general professional engineering act are not permitted to practice structural engineering or architecture unless registered under the acts covering such practice.

Clarified examination requirements

One of the chief weaknesses of the old law cited by the Supreme Court was its provisions regarding the examination of applicants. Under the old act, the applicant could, at the discretion of the examining committee, "select from groups of questions pertinent to several branches of engineering that group which, in the examinee's opinion, most nearly covered his professional engineering experience." Having successfully passed such an examination in a limited, or specialized field of engineering, the applicant then could practice professionally in any branch of engineering. This, the court said, was entirely out of reason. The court also said that no applicant can determine by reading the act the necessary requirements to entitle him to examination.

The new law undertakes to eliminate these defects by dropping the old provision for examination in a field selected by the applicant and by stating that "Examinations compiled by the State Department of Registration and Education shall embrace the subjects required of candidates for a baccalaureate degree in engineering by the College of Engineering of the University of Illinois."

Likewise, in setting up a standard for the approval of engineering colleges from which credits can be applied towards an applicant's registration, the act specifies that such colleges must have curricular requirements equal to or not less than those of the University of Illinois.

Operational funds provided

One clause in the new bill provides for an operational fund of $55,000 with which to administer it for a two-year period beginning July 1, 1945. Although the act has not yet become law officially, its recent successful passage by both houses of the state legislature, together with the reported favorable consideration by the Governor of Illinois indicates that its adoption is only a matter of time. Since the act carries no effective date it will become effective July 1, 1945, under the Illinois state constitution. Actual registration of Illinois professional engineers, however, is not expected to get underway for several months due to anticipated delays in printing registration certificates.

Up until Aug. 1, 1944, the expiration date of the "grandfather clause" of the old act, 8,900 applications for registration had been filed. The expiration date for registration under the "grandfather clause" of the new act is one year after the act becomes effective. Between 20,000 and 22,000 Illinois professional engineers are expected to apply ultimately.

Principal exponent of the act was the Illinois Engineering Council which is composed of twelve member local sections of national professional societies or regional societies operating within the state. It represents a majority of those engineers who are members of any technical society in Illinois.

Clearing of TVA Reservoir Areas Aids Mosquito Control

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***Contents in Brief**—Ground clearing plays a major part in pre-impoundage conditioning of TVA reservoirs, since it is important to mosquito control for prevention of malaria, as well as to safe navigation and to protection of the dams. The organization and methods used on the work are described in this article, as are a timber rake and a bank-pulling machine developed by personnel of the reservoir clearance projects.*

ADEQUATE PREPARATION of the areas to be inundated by waters stored behind the Tennessee Valley Authority's great dams presented a problem of no mean proportions. Not only was it necessary to remove existing and potential hazards to navigation, but it was also necessary that there be a minimum of flotage on the lakes in order to inhibit breeding of the malaria mosquito. Unless a thorough pre-impoundage clearing job was done in the marginal areas of these lakes the health of those living in the vicinity would certainly be endangered in after years, as the marginal growth and the flotage in quiet waters would provide ideal conditions for reproduction of *Anopheles quadrimaculatus* mosquitoes, the principal malaria vector in this region where the disease is endemic.

Solution of the clearing problem was delegated to a reservoir clearance division set up as part of the construction department so that it could arrange its schedule to have each reservoir ready in time for closure of the dam. The thorough preparation of the flooded areas by this division, when coordinated with water level control measures on the completed reservoirs, gave results in eliminating the malaria mosquito that have, under similar conditions, never been surpassed. In this preparation, however, several different interests had to be considered.

For the reservoirs on the Tennessee River, navigation considerations required that all timber be cut, piled, and burned or removed (Fig. 1); but for the mountain reservoirs timber that would always be submerged was left standing, and that which would

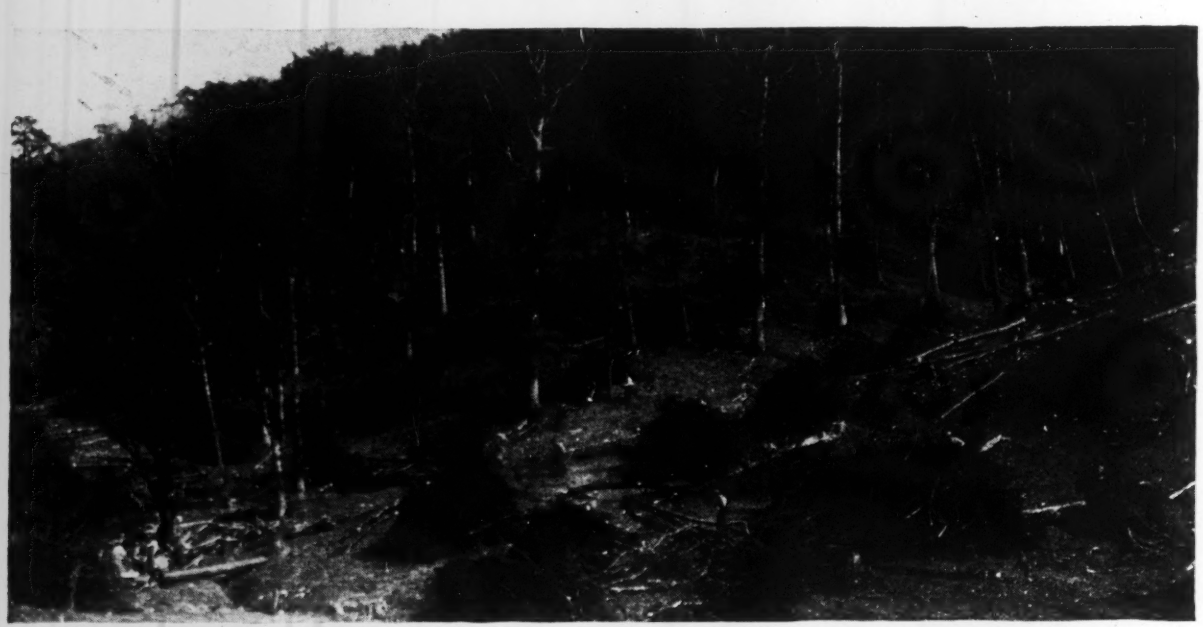


Fig. 1. Biggest and most important job in TVA reservoir conditioning was to clear away the forests. Here bush hook and ax men have cut the underbrush and smaller timber, and saw crews are felling the larger trees. A mule team (lower right) has just moved in to snake the logs into beds for burning.

pierce the surface during low-water periods was felled and wired in place.

Drawdown area is critical

In every reservoir, however, a rigid job of clearing had to be done in the zone of fluctuation—from the normal pool level down to the elevation to which the water would be drawn during the dry season. This represented much the greater part of each mountain reservoir area, including many thousands of acres of swampy areas that would be exposed at the low-water stage of the main river reservoirs (Fig. 2). Clearing these areas meant cutting all trees, shrubs, stumps, posts or other projections as close to the ground as possible, usually not over 6 in. high.

To make sure that as little debris as possible would later find its way into the lakes, the clearing division was asked to burn all dead and leaning timber, undesirable species of trees, logs, drift and other debris within 10 ft, (slope distance) above the proposed water line. Where shorelines would be exposed to the main body of the reservoir and were of a soil likely to be quickly eroded by wave action (Fig. 3), this clearing was carried back as far as necessary to care for potential erosion, sometimes as much as 20 ft. on the slope.

Trees of upland species along the proposed margins were another potential source of debris because when their roots were inundated during the growing season they would die and fall into the lakes. To avoid this the slope was cleared a distance of 15 ft. or a vertical distance of 1½ ft. above the shoreline. Roots of trees outside these limits were generally beyond the reach of the destructive action of water.

Field organization

Usually, from two to five reservoirs were undergoing preparation at the same time, although at one period there were nine. This wide distribution of activities called for a closely-knit organization, finally realized by setting up a field organization under a superintendent at each major reservoir site.

Each superintendent had one or more assistants in direct charge of clearing, each of whom had a group of units under his direction. These work units of the division were each composed of about 65 men and were

Fig. 2. This great swamp area in the zone of fluctuation has been cleared in readiness for impoundage.

further qualified by their assignments, such as "clearing" units, "bank" units and "burning" units. The base strength of 65 men could be varied according to the assignment. For instance, bank units sometimes had as many as 85 men, while burning units often were reduced to 30.

Each unit was a well-rounded organization working independently of all other units. In charge was a unit foreman, who reported to the assistant superintendent directing the work of his group. Under the unit foreman in a clearing unit were three labor foremen, each directing a group of men in some distinctive phase of the unit's work. Each unit also included a clerical first-aid laborer, a saw filer, and an ax sharpener. With such a set-up, the operations on each project—and therefore the operations of the division as a whole—were always kept in balance.

How operations were scheduled

Operating on a simple routine, the clearing units would enter an unbroken forest and leave a completed area behind—debris piled and ready for the burners; timber to be salvaged left on the ground, to be later removed by the contractors. The operational procedure was as follows:

Under one of the labor foremen, a group of workmen armed with bush

Fig. 3. On shorelines exposed to the main body of the reservoir and of a soil likely to be quickly eroded by wave action, clearing above the normal pool elevation was desirable. This is a section of shoreline on Pickwick Lake, shortly after the reservoir was filled. Sluffing, as shown here, gradually forms a sloping beach and erosion stops before it reaches the timber line.

hooks and axes cut the undergrowth and smaller timber. All brush was piled and poles were cut in lengths of 12 to 14 ft. Poles that one man could readily handle were thrown into the brush piles, but larger poles were left for other disposition. With this group sometimes went one or two saw crews to cut small timber that would not have to be wedged. There was usually a "dead timber" saw, operated by two experienced men, to cut dead and unsound trees ahead of the advancing unit.

Directly behind this vanguard, under another labor foreman, came the saw crews. These felled the large timber, cut off the limbs and piled the brush, cut the logs into lengths of 12 to 14 ft. for piling, and into sawlogs according to specifications.

Following the saw crews came mule teams, which snaked the logs that were to be burned into beds about 30 ft. wide. Lug-hook crews (the piling crews) then set these logs up into piles. They brought in the poles that two men could carry and placed them on top. This made a pile of waste logs 12 to 14 ft. long, about 8 ft. at the base, tapering to a top 3 to 5 ft. from the ground. Saw logs were left for later removal by the contract sawmills. Mule teams and piling crews were under the direction of a third labor foreman. In large timber, using loading chains, the teams helped with the piling by rolling the logs up into place. As soon as the brush and logs had dried for a few weeks the area was ready for burning.

Special machines developed

Along the banks of the Tennessee River and its major tributaries, clearing was done by bank units, assisted in their work by a bank-pulling machine (Fig. 4, upper) developed by one of the superintendents. This machine, powered by a D6 Caterpillar tractor, was equipped with a side winch, short boom, and stiff leg. It was run by an operator and manned by a crew of from five to seven men to handle the cable. Instead of having to resort to the slow and costly method of swinging leaning trees from over the river with blocks and ropes, they were cut and let fall into the water. Then the bank-pulling machine drew them out on top of the bank for conditioning (Fig. 4 lower).

Fig. 4. Without the bank-pulling machine shown in the upper picture, clearing timber that leaned over the water would have been a real problem. Powered by a tractor, each machine was equipped with a side winch, short boom and stiff leg. The lower picture shows a typical crew, which consisted of an operator and from five to seven men to handle the cable, pulling felled trees from the river.

A timber rake (Fig. 5, left), which revolutionized clearing methods on flat areas, was developed and built by the division. Powered by either D8 Caterpillar or HD14 Allis-Chalmers tractors, it was equipped with specially-designed teeth hung on a bulldozer blade. A cable lift operated the blade, while "duck breasts", or slides, kept the blade at working elevation.

For these machines, timber had only to be felled, and was left without conditioning. Stumps were cut low, not more than 6 or 8 in. high. Over these the enormous loads, cradled in the curved teeth, were lifted with ease. Usually two abreast, for they worked most efficiently in pairs, timber rakes gathered the trees on their teeth and shoved them forward (Fig. 5, right). Presently a great mass of timber was rolling, crashing, splintering in front of the powerful machines. When they could proceed no further with their load, they returned for another and hammered it into place beside the first, until a great wall of crushed timber lay across the terrain. On the other side of the wall, they repeated the operation, which resulted in a giant windrow. When this had seasoned it burned readily and almost completely.

In mountain reservoirs, while the drawdown was sometimes more than a 100 ft. vertically, the areas covered were by no means as large proportionately as on the Tennessee River. Here, the problems of clearing were altogether different from those in the flat country. Thus on steep mountainsides there was always the danger of loosened boulders and rolling timber. Clearing units working up the mountain were disposed across the slope at a 45 deg. angle, so that no man was ever directly below another. Along the top contour, brush was pitched at

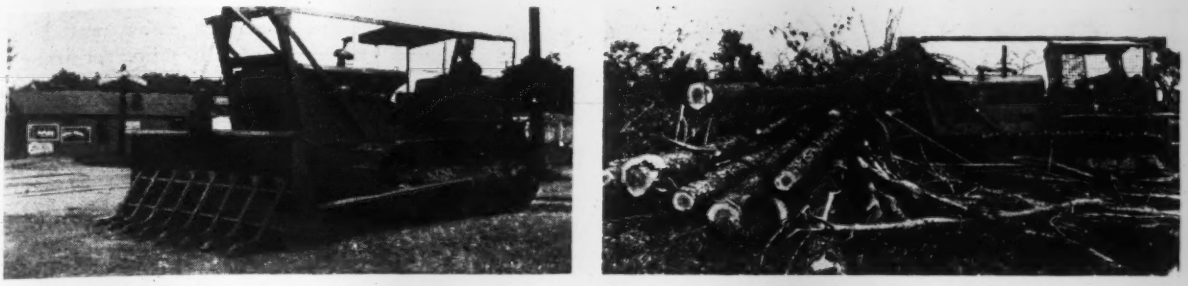


Fig. 5. Timber rakes of the type at left revolutionized clearing methods on flat areas. Developed and built on the job, they were equipped with specially designed teeth hung on a bulldozer blade. A cable lift operated the blade, while "duck breasts," or slides, kept the blade at working elevation. In later models the number of teeth was reduced to three. How the rakes, usually working in pairs, shoved the debris into huge windrows for burning is shown at right.

least 30 ft. down from the timber line, so that, when it was later burned, the flames would not go roaring up into the forest. To prevent their sliding or rolling, logs were piled at an angle of 45 deg. to the slope, usually scotched behind a stump.

On sheer bluffs, where no footing could be found for the workmen, they were lowered over the cliff's edge in saddles. Armed with axes, they chopped away the timber as they descended. To avoid the chance of its being cut by a sharp rock projection or an unlucky stroke from the ax, rope with a metal center was used.

On the stream banks in the mountains, where they were accessible, small crawler-type tractors with tail winches were used to help with the leaning timber. Clinging to a steep slope at a precarious angle, these little machines worked quite efficiently.

In the flat country, burning brush and waste timber behind clearing operations was no great problem. It was usually done by small contractors, who took the job for $3 to $6 an acre, depending on the nature of the debris. Generally, these contractors were local farmers, living not far from where the clearing had been done.

Fire hazard serious in mountains

In the mountains, because of the ever-present danger of fire escaping into the forest above the upper contour, burning was very carefully supervised. In fact, because numerous whirlwinds had a disconcerting habit of picking up live coals and depositing them in the woods beyond the clearing line, a large part of the cost of this burning in the mountains was absorbed in raking an adequate fire lane just below the timber line to check ground fires, and in patrolling the timber line itself.

If the trees were cut when in full leaf, the dry brush heaps were no trouble to burn, but with the brush bare of foliage (as when cut in winter) their complete consumption by fire was quite another matter, especially when the heaps had become soaked by intermittent rain. Log piles were set in the top. Two or three of the top poles were rolled aside, a little "crow's nest" of dry litter was placed on the pile and set on fire, and the poles replaced. Once the fire had taken hold, live coals would continue sifting down through the logs until the whole pile was fired. Bed logs were always placed flat on the ground—never on poles—and these big logs usually were burned completely.

Just prior to the filling of each reservoir, crews went over the margins and, in the drawdown areas, cut all coppice and all sprouts from stumps that had grown since the land was cleared. This was done by men armed with bush hooks and scythe axes. Horse-drawn and power mowing machines cut cornstalks and annual growth. Hay rakes were then used to pile all of this debris in windrows so it could be burned.

Whenever possible, this schedule of final preparation was begun after the growing season in September and completed before the winter rains set in during December. When the lake filled during the winter—especially if it remained at normal pool level during the first month of the growing season the next spring—most of the coppice roots and a large part of the annual growth were killed beyond any chance of sprouting. If, in addition to this beneficial condition, there was a surcharge when the lake was first filled, bringing the water a foot or so above the top contour, small trash and litter were well stranded when the water was drawn down to the normal pool level. Then, indeed, a clean shoreline was obtained and, with a complete system of drainage in the marginal areas, the fight for the control of malaria mosquito breeding on the lake was practically won.

Cost of clearing operations

In the authority's reservoirs, "regular" clearing—as distinguished from "bank" clearing—was done for 16.6 man-days per acre. Clearing along the stream banks, where much timber of enormous size had to be cut to ground level for safe navigation, ran to an average of 22.5 man-days per acre. Where timber rakes were used and the timber did not have to be conditioned for piling, the man-days per acre were, of course, less, though each man-day cost more. Out on the flats, the job was done for 8 man-days while on the banks it ran to 15 man-days per acre.

Felling the timber below the drawdown in mountain reservoirs, in preparation for wiring in place, was done for an average of 2.7 man-days per acre. Wiring the timber, which included that which came from above, took about 6 man-days per acre.

The burning of all debris, both contract and force account, was done at an average cost of $7.84 per acre.

A total of 182,000 acres of clearing, burning, and wiring was done at an average cost of $86.52 per acre. This included the cost of draining swamp areas not included in the drainage for malaria control, but which had to be drained before they could be cleared.

A second article by Mr. Ellis, describing the methods used in digging drainage canals for mosquito control in the TVA reservoir areas, is scheduled for early publication.—Editor.

Outlet for Drainage Channels Through Sand Beaches

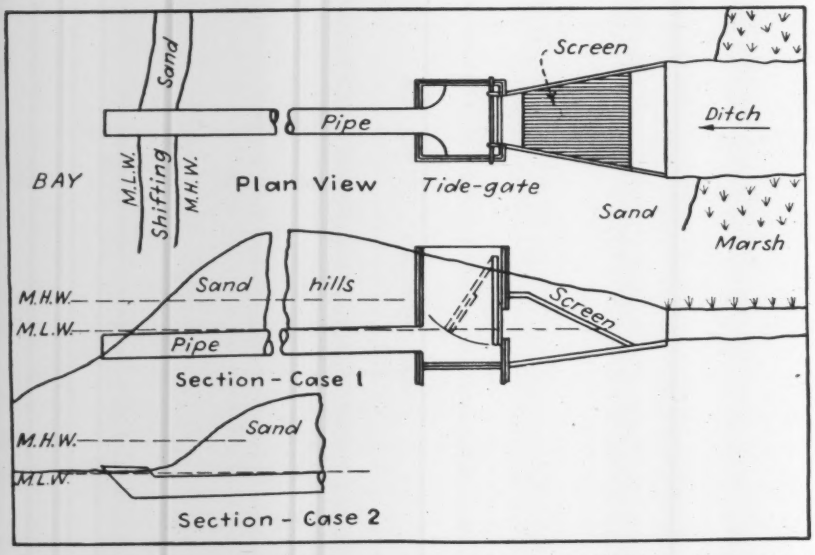
PROVISION of an adequate outlet is the most important operation in constructing a drainage project, especially when that outlet is through a shifting sand beach in tidal waters. In such locations ditches cannot be kept open because waves move the sand into the ditch mouth, effectively blocking it as soon as flow in the ditch stops. This latter condition occurs whenever the tide is at the same level as the marsh water inside the beach.

In order to provide effective outlets to its drainage systems in several land-locked marshes along the Delaware Bay shore, the mosquito extermination commission of Cape May County, N. J., developed a design that has proved eminently satisfactory. A typical structure as described by O. W. Lafferty, superintendent of the commission, in a paper presented at a recent annual meeting of the New Jersey Mosquito Extermination Association, is adaptable to most sand beach conditions in coastal areas.

Essentially, the outlet consists of a sluice or pipe whose discharge end is carefully located with respect to the shifting sand area, and whose inlet end is protected by a suitable tide gate in a well located back of a high point on the beach. But in adapting the basic design to the local situation, certain principles evolved from observation of previous installations should be considered.

Where to locate pipe end

Thus, when a beach is steep, as in case 1 on the accompanying drawing, the pipe may continue straight out to deep water and discharge below the low-water mark. In case 2, however, where the beach is very flat, experience shows that ice floes cause great damage to beach structures during the winter, making it inadvisable to allow the outlets to protrude more than 100 ft. beyond the high-water mark. In this latter case, the discharge end of the pipe may consist of an elbow turned up to give a 6-in. collar extending to or slightly above the level of the sand. In either case the top of the pipe should not be higher than mean low-water in order that the entire cross-sectional area may be utilized for drainage at any stage of the tide, so long as the water level inside is higher than the tide.



This non-plugging outlet for drainage systems through sandy tide-water beaches is adaptable to a wide variety of conditions. Case 1 shows location of the pipe end with respect to low-water mark on a steeply sloping beach; Case 2, on a flat beach. A wooden tide prevents inflow when the tide is above marsh water level.

The discharge elbow must be securely fastened to piling set firmly in the beach, for the outflowing water will spill over and tend to wash away the supporting sand. Because the elbow will reduce the culvert capacity, it should be used only where the length of pipe necessary to reach deep water would be excessive.

The inner end of the pipe is located in a wooden well, which also contains a wooden pendulum-type tide gate. This style of gate is preferred because it will swing clear of the entrance to the pipe, and its light weight makes it very sensitive. A gently sloping bar screen affixed to the inlet end of the well is so arranged that high-water drift material is placed near the upper limit of the screen, leaving the lower portion unobscured to take care of the low-water flow. In some locations an additional gate is installed on the upstream side of the well so that the local owner may flood the marsh at will during the winter by allowing the tide to enter and preventing its outflow.

Tide gate, gate well, screen and feeder ditch are all of much larger cross-section than the drain pipe so as to reduce velocity, thereby reducing hydraulic losses and promoting settling of any slit in open areas where it can be readily cleaned out. Also, the entrance to the pipe is streamlined to reduce any turbulence that would reduce the pipe capacity.

Wood sluices preferred

Outlets have been constructed of cast iron pipe, terra cotta and cement pipe, galvanized iron pipe and hexagonal wood pipe, but creosoted North Carolina pine and paved and coated corrugated galvanized iron pipe have proven most successful. The other materials tend to be broken by ice movement or abraded by moving sand. Hot-dipped galvanized hardware is used when available, as nails and bolts galvanized by blow pressure seldom last over three years.

Installed by the Civilian Conservation Corps in 1938, a unit using 36-in. paved and coated corrugated galvanized iron pipe cost $40 per ft., of which $6.45 was for materials and the remainder for assembly. By contrast, a 24x48-in. unit of creosoted 2-in., No. 1 North Carolina pine has been installed for $17.22 per ft., $1.27 being the cost of materials in this case.

Railroad Relocation Through Hammond Facilitated by Indiana Legislature

WHOLESALE REROUTING of four trunk line railroads through Hammond, Ind., designed to eliminate 43 grade crossings, received added impetus recently when the Indiana State Ligislature passed an act drafted specifically for that purpose. The project has been under consideration for several years, with the first plan being prepared in 1928. It is estimated to cost in the neighborhood of $20,000,000 and will take at least three years to complete.

Act made general

Although the act mentions no specific town, it applies only to Hammond since that is the only Indiana city qualifying under the terms of the act which reads in part: "This bill provides a method by which cities with a population between 65,000 and 100,000, and having not less than eight trunk line railroads, may bring about grade separation." The act also provides for the creation of a grade separation district for the purpose of selling bonds to pay the city's share of the cost, and for the making of special assessments to benefitted areas.

The plan, which was first initiated in 1928, was such that it could not be put into effect without special state legislation. Enabling legislation was enacted the following year empowering Hammond to put the plan into effect and providing for a division of the cost, 60 percent to the railroads and 40 percent to the city.

Planning stopped by depression

Under this act, the city and the railroads working in cooperation, had tentatively agreed on a plan but the depression curtailed the revenues of the city and the railroads to such an extent that it was impossible to proceed with a further consideration of the project.

In 1939 the legislature enacted a general grade separation law which limited the railroads' participation to 20 percent of the cost. When consideration of this project was revived by a citizens committee in Hammond in the fall of 1943, it was evident that the project could not be put into effect if the railroads' share of the cost was to be limited to 20 percent of its total cost.

The law just passed by the legislature reenacts many of the provisions of the 1929 act and empowers the city to enter into agreements with the railroads, the county and the state on the question of division of cost.

Many grade crossings will be eliminated in Hammond, Ind., by relocating four railroad trunk lines in one joint right-of-way. As both the city and the country are to be benefited, they share in the cost of the work.

Basically, the proposed improvement is designed to eliminate a bottleneck in railroad transportation between Chicago and points east and south. The need for this improvement has been apparent for several years and the present large volume of traffic proves it to be particularly critical during wartime. The four railroads affected are the Erie, the Monon, the Nickel Plate and the Chesapeake and Ohio.

One joint right-of-way

Under the proposed plan, all four railroads, now passing through Hammond in widely separated rights-of-way, will be relocated and combined in one joint right-of-way. This will permit the abandonment of considerable length of the present Chesapeake and Ohio, Erie and Monon tracks, thereby eliminating a great many grade crossings. Moreover, much of this trackage to be abandoned has been used for years in making up long freight trains, which in itself created a public nuisance by tying up vehicle traffic over long periods in that part of Hammond.

Proposed relocations

Present plans are to provide one track for the Monon, two for the Nickel Plate and two tracks for the Erie Railroad, which also serves the Chesapeake and Ohio. Starting near the southeast limits of Hammond, the new trackage will extend north for about 12,000 ft. at which point it will turn west and run along the present Nickel Plate right-of-way for a similar distance. At this point the five tracks will be carried over the existing New York Central and Indiana Harbor Belt main line tracks on a 1,000-ft. long viaduct to be built on a 2-degree curve.

After leaving the viaduct the five tracks will be brought down to grade and four of them will be carried over the Grand Calumet River on a 275-ft. span skewed vertical lift bridge. The Monon track will cross the river on its present bridge, which will be raised to provide proper clearance above the water.

Rearranged switching yards

Other items in the proposed plan include the abandonment of present switching yards of the Mono and Erie railroads, in the west edge of Hammond, construction of new switching yards for these two railroads and the installation of interchanges with the Indiana Harbor Belt Railroad operating in the area.

For simplification, the railroads are shown as single lines on the accompanying map. In most instances there are two or more tracks. Old and new yard locations are indicated.

Preliminary plans for this railroad relocation project have been prepared by Edward J. Noonan, consulting engineer, Chicago. Construction is expected to start shortly after the war following approval of the plans and agreement by the participating agencies as to the amount of funds each will provide. A. D. Millard, city engineer of Hammond, represents that city in the negotiations.

Fig. 1. Earthquake-resistant construction was incorporated in the main building of New Tripler General Hospital.

Rigid-Frame Army Hospital in Hawaii Designed to Resist Earthquakes

***Contents in Brief**—Since the Hawaiian Islands lie within an earthquake zone, provision for seismic disturbances has been made in the design of all major structures of the New Tripler General Hospital, now under construction on Oahu Island. The multi-story main building will be a concrete rigid-frame designed to resist lateral forces equal to 0.02g, and the foundations will be tied together to assure uniform action; in addition, the building will be divided into 12 structually isolated units to provide for variations in deflections under earthquake forces. Other design features are the adaptation of native architecture to achieve informality and unity, the advantages taken of the sloping site, the use of wide, shallow beams and the utilization of a special torsion bracket to transfer moment and shear from the concrete beams to steel H-core columns.*

EARTHQUAKE-RESISTANT DESIGN is one of the distinguishing features of the buildings comprising the New Tripler General Hospital, which the Army now has under construction in Hawaii. This design incorporates the use of rigid-frame, reinforced concrete construction, tied foundations and the subdivision of buildings into structurally isolated units.

Also commanding attention is the floor system design for the main hospital buildings, which utilizes wide, shallow concrete beams; some of these are 72-in. wide and but 20 in. deep. And the use of torsion brackets for moment and shear transfer from beams to columns, where steel H-cores were used in the more heavily loaded vertical members, is another unusual detail.

Besides the structural characteristics that are outstanding, attractive solutions to the problems posed by architectural considerations and the location of the project have been found.

To be built on mountain

Situated on the lower westerly slopes of the Koolau Mountain range about four miles northwest of Honolulu, Hawaii, the hospital will furnish to U. S. Army personnel and their families in the Pacific area complete general medical service. The principal hospital buildings will provide 1,500 beds, with future expansion to 2,000 beds planned. In addition (Fig. 2), there will eventually be provided quarters for officers and enlisted personnel of the hospital staff; quarters for nurses; a chapel, a theatre, a gymnasium, post exchange, and other recreational facilities; a research laboratory; and warehouse and service facilities. The current construction program allows for an expenditure of $16,000,000.

The project is located on a 360-acre site, about 1¼ miles long, with an average grade approximating ten percent and an average elevation of 400 ft. above sea level. Situated on a broad ridge flanked by Moanalua Gulch on one side and a tributary stream bed on the other, the site is rugged in topography, well adapted to dispersal of individual buildings and groups of buildings according to classification, and affords for all principal structures unobstructed views of the Pacific Ocean.

Certain of the service buildings are planned to take advantage of the sloping site. For example, the laundry building is arranged functionally and topographically to permit soiled laundry to enter at grade at the third

floor level at one end of the building, pass down through the structure by gravity chutes during the cleansing processes and be dispatched clean to a loading platform at grade at the first floor level. Another example is the warehouse and commissary, a two-story building each story of which will house supplies in different categories and will have its independent entrance and loading platform at grade.

Fig. 2. Because the site is about 500 ft. higher at the east end than at the west, the roads wind to avoid steep grades, and service buildings are designed to take advantage of the sloping site. Structures indicated on the site plan by dotted lines will not be built under the present appropriation.

Region subject to earthquakes

In the design of the principal structures considerable thought was given to the possibility of earthquakes. Although the Hawaiian Islands are of volcanic origin and lie within an earthquake zone, there is no record of seismic disturbances of heavily destructive intensity. However, moderate shocks due to earth movements are not uncommon. Therefore, after careful study of the geological history of the islands, it was decided to design all major structures with provision for severe earth tremors, but not for earthquakes of maximum severity.

Structural frames were designed to resist lateral forces equal to 0.02 g, allowing a 33 percent increase in normal working stresses for combined gravity loads and lateral forces. Later, it was found that the main building structure had an *ultimate* capacity of 15 percent of the gravity forces for bending and shear, but that the overturning moment was critical. In order to take advantage of the ultimate capacity, it was decided to strengthen the structure against overturning so that it also will be stable for horizontal forces of 0.15 g. This is believed to be equivalent to assuming lateral forces 50 percent greater than those produced by the severest earthquake of record.

The structural frames of all principal buildings will be of reinforced concrete. Structures such as the boiler plant, laundry, utility shops and incinerator will have concrete exterior walls, formed with plywood. All other major buildings, including the main hospital, will be of concrete blocks and will have stucco finish on the exterior. These block walls will be safeguarded against cracking by a system of reinforcement located at critical points and consisting of steel pencil rods laid in horizontal block joints. This system, when properly used, has proven over many years of experience to be effective. Interior partitions also will be of concrete block.

Earthquake joints provided

In anticipation of variations in direction, frequency and amplitude of variations of different mass elements of the main hospital building group under seismic disturbance, the structure is divided in plan into twelve individual units, each structurally isolated from adjacent units. In addition, the connecting passages between hospital units are isolated from the main building structure.

Structural isolation is accomplished

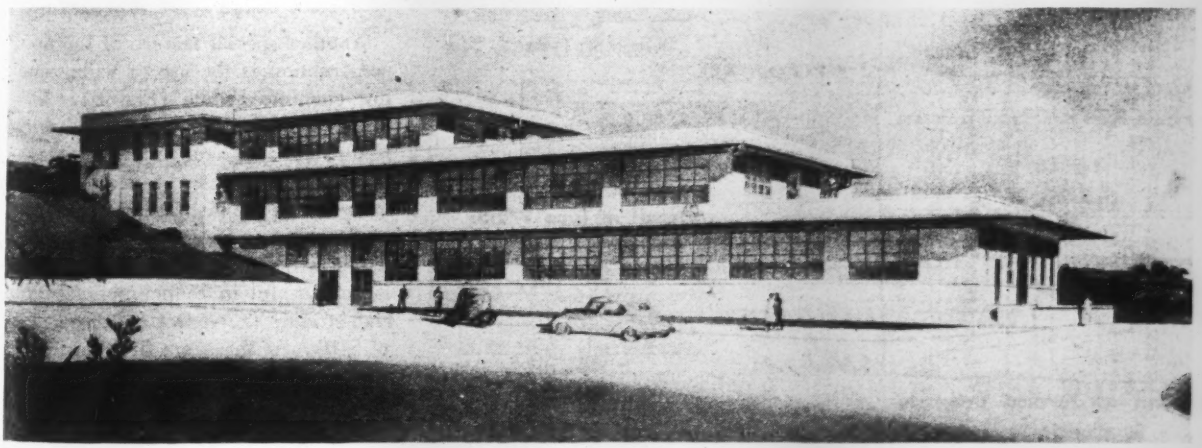


Fig. 3. A service road will lead to the third floor level of the laundry building, where material will enter at grade. The laundry will be chuted downward during the cleansing processes and will leave the structure at the first floor level.

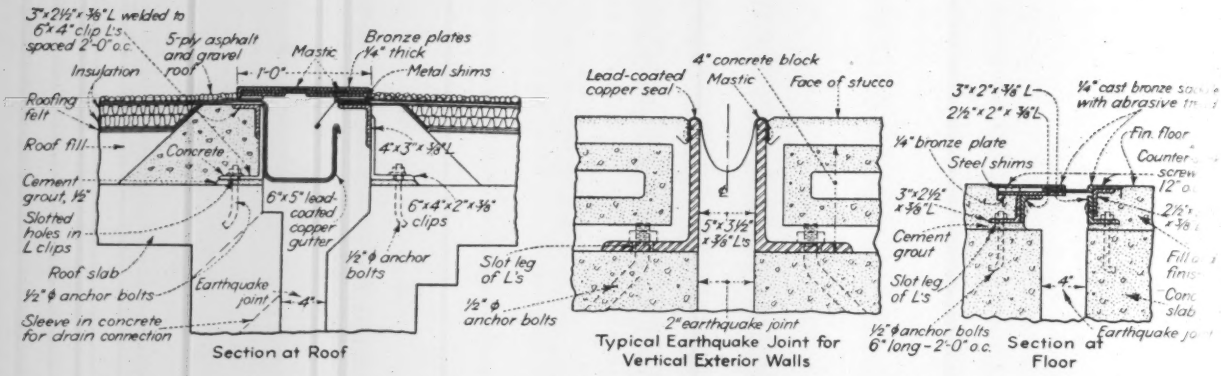


Fig. 4. Should seismic disturbances occur, earthquake joints will permit the different units of which the main hospital building is composed to move independently.

by the use of double concrete walls between adjacent elements, with a space left between the walls. The space is closed at exterior wall faces by means of a flexible flashing so devised as to permit lateral movement in any direction (Fig. 4), and at the interior corridor and door openings by means of interlocking sliding thresholds and flexible sliding head and jamb plates. The double walls are supported on a common footing to avoid unequal settlement.

Walls also play a part in resisting earthquake forces. The floor systems of the main hospital units were designed to carry the lateral earthquake forces to the end walls and to intermediate earthquake walls. These walls, of solid reinforced concrete, are planned to act as vertical cantilevers and to transmit the seismic forces to the ground. To decrease the danger of concrete stairs being fractured by earth tremors, the stair wells and elevator shafts are enclosed by solid concrete bearing walls that are integral elements of the structural frame.

Rigid frame design

To better resist the lateral seismic forces, as well as to benefit from other advantages of monolithic construction, all principal buildings throughout the project were designed as rigid frames by using the method of moment distribution. After the basic design had been determined, moment factors were established and used in order to expedite the progress of design. Shear stresses produced in transmitting beam reactions to columns were analyzed using the principle of diagonal tension as usually applied in the design of footings.

When detail studies were made of continuity in the main hospital building structural members a problem arose. Since the center portion of the structure is equivalent to 13 stories in height, the loads carried by some of the lower story columns approximate 750 tons. In order to conserve valuable floor area, it was found necessary to use structural steel H cores in these heavily loaded columns. Since no structural steel beams or girders are used elsewhere there arose the question of how to transmit the shears and moments from concrete beams into these steel column cores.

The connection detail selected consists of seat angles and torsion brackets composed of heavy steel beam stubs welded to the columns (Fig. 5). At points where pipe line risers occur adjacent to these columns, special torsion brackets consisting of heavy, yoked channels were used. All such torsion brackets required careful, detailed study of the arrangement of reinforcing steel.

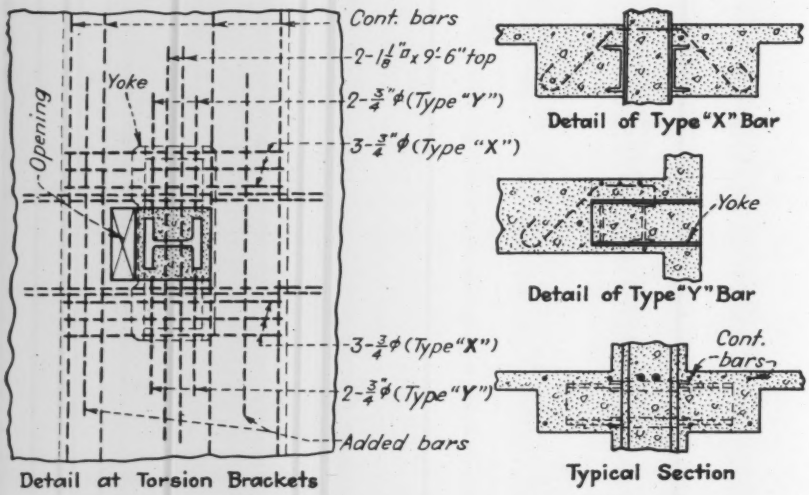


Fig. 5. Typical details at a torsion bracket on a steel column core illustrate the provisions made for transferring moments and shears from the beams into the steel core. Note, also, that the beams used are of wide, shallow section.

Shallow beams found economical

Another special feature of the floor construction is the use of wide, shallow concrete beams (Fig. 6). This design permits the use of the wide beam stem as a haunch to resist negative slab moments. Since negative moments in the slab at the beams exceed positive moments, the additional depth provided the slab by the beams is very useful in reducing maximum slab stresses (*ENR* Oct. 19, 1944, vol. p. 510). At the same time the effective slab spans are decreased, and as a consequence the positive moments are lowered.

This type of construction is believed by the designers to be practical and

economical since it provides for a distribution of material more in conformity with the critical stresses than does ordinary beam and slab construction. The shallowness of the beams permits lower story heights, and their width is convenient for mechanical work, since they can be perforated vertically for pipe lines and ducts merely by introducing specially arranged reinforcement. Also, the resultant proportions of these wide shallow beams are expected to be pleasing in appearance where they are exposed on the ceilings of the large ward rooms.

Foundations influenced by quakes

Possibility of earthquakes influenced the design of foundations as well as that of superstructures. To assure uniform action of the main hospital building under seismic disturbances, all foundations and foundation piers are tied together at their tops with a system of reinforced concrete struts or tie beams (Fig. 7).

Foundation design includes several different types of footings, with conditions sometimes dictating an abrupt change of types between adjacent footings. Where mixing of the various types was unavoidable, proper precautions were taken in the design to prevent unequal settlement. In general, the footing types are as follows:

(a) Spread footings bearing on thick rock layers near the surface;

(b) Spread footings on deep piers carried down to thick rock layers or "lenses";

(c) Spread footings bearing on thin rock layers, with the underlying layer of cinders pressure-grouted for compacting (by this method a lower rock lens is engaged for additional bearing);

(d) Steel H-piles used as friction piles with a maximum capacity of 40 tons per pile regardless of driving penetration.

The soil formation upon which these buildings are being founded is the result of original lava flows from craters and vents of the Koolau Mountain Range, with some strata from secondary eruptions. This volcanic deposit has been altered in place by decomposition to produce a confused and unpredictable stratification of materials of varying densities. Even though no underground "lava tubes" were encountered, the foundations presented a serious problem.

Topsoil and subsoil are composed of heavy red lateritic clay, which is a derivative of the basalt of the region. This clay, which extends to an average depth of about 20 ft., is dense and impervious and stands safely in excavations of great depth without shoring. The foundations for all buildings except the main hospital group were designed for the use of spread footing on this sub-soil at bearing values of one and two tons per sq. ft.

Foundations for the main building are affected to a greater extent by lower strata. Underlying the surface clay are transitional layers of soil and decomposed basalt of varying hardness, interspersed with dense unaltered basalt boulders, "lenses" of basalt, and layers of volcanic ash. No bedrock was found for 200 ft. Obviously, these conditions did not lend themselves to simplified foundation design.

Numerous preliminary core borings were taken over the entire building site, on the basis of which a design was developed for spread footings bearing on rock strata with a minimum capacity of 8 tons per sq. ft. General excavations at the building site disclosed however, that the great variations in soil strata would not permit such a loading. It was then decided to take core borings at each column location and to have the type and design of each column footing determined individually in the field.

Although the buildings of the hospital are all permanent structures, the assumed design stresses conform to War Production Board Directive No. 29 in order to conserve critical materials. The concrete mix for superstructure construction was specified to meet a 28-day strength test of 3,000 psi., while foundation work was designed for a test strength of 2,500 psi. However, actual samples of ready-mixed concrete taken during the early stages of foundation construction were found to be testing as high as 4,000 psi. Therefore, field adjustment of the specifications is being made to save materials.

Architectural treatment

In addition to the outstanding structural features, the architectural treatment of the project is also noteworthy. An effort has been made to avoid an institutional atmosphere and

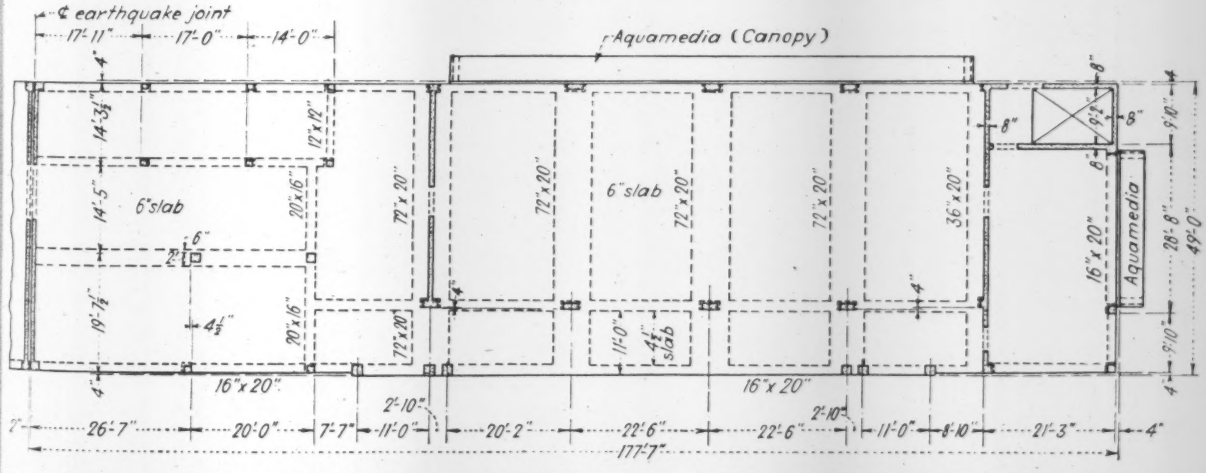


Fig. 6. This typical floor plan illustrates the use made of wide shallow floorbeams in the main hospital building. Double walls divide the structure into individual units separated by earthquake joints.

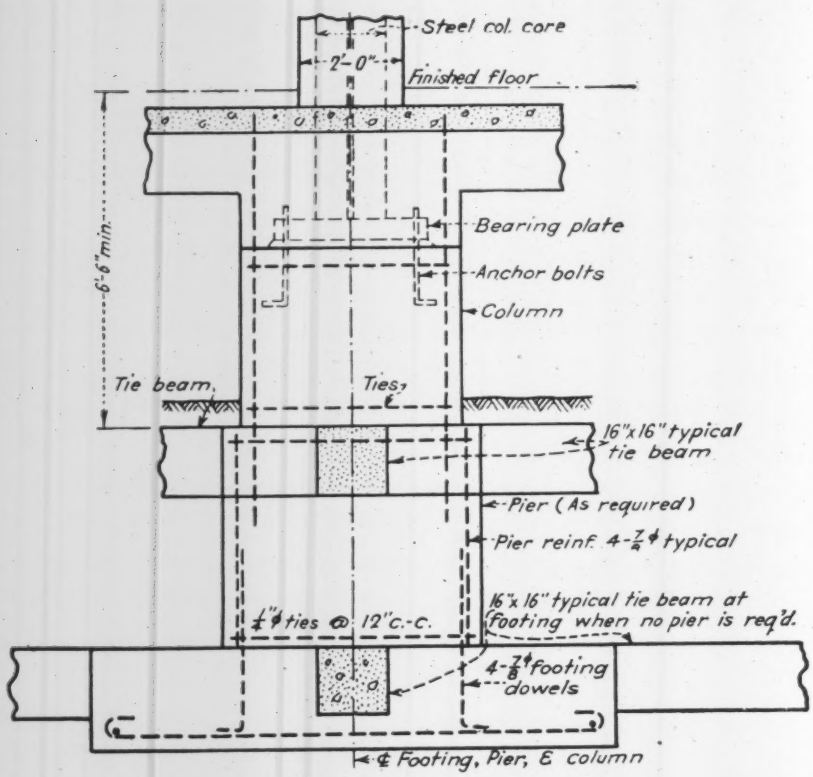


Fig. 7. Spread footings of the main building were assumed to bear on rock with a minimum safe bearing capacity of 8 tons per sq. ft. However, since soil conditions vary considerably, some footings may be redesigned in the field.

to achieve for the whole project the character of a residential community. Informal grouping of buildings, irregular plans, generous use of *lanai*, or porches, and the adaptation of native architectural characteristics are a few of the means of accomplishing this result. In this respect the irregular topography of the site is an advantage, because it dictated the use of winding roads in order to avoid steep gradients and excessive cut and fill.

Buildings are oriented in such a way as to take full advantage of prevailing winds, which blow down the sloping site from northeast to southwest. This climatic condition was a determining factor in the final plan of the main hospital group of buildings, which are so arranged as to function on the principle of an anemostat or air-diffuser operating in reverse. Thus, the prevailing winds are deflected to provide maximum cross-ventilation of all units of this group.

With the exception of certain of the service buildings which are of cast concrete construction throughout, the exterior surfaces of principal buildings and retaining walls on the site are to be finished with stucco in a warm, pink-coral color. The administration wing of the main hospital building, which includes the main entrance porte-cochere, is to be faced with cast stone.

The porte-cochere columns and projecting *aquamedia*, or canopies, are detailed so that the cast stone facing serves as a form into which the structural concrete is cast. The result will be a concrete monolith with a surface finish of especial interest.

Exposed architectural concrete surfaces are to be treated with a variety of finishes. The smooth soffit surfaces of projecting canopies of the main buildings are being formed with absorptive liners of a rigid board manufactured locally from sugar cane. This treatment is also used on the soffits of all covered terraces of the main hospital to produce a soft, "sand-finished" exterior.

Surface treatment of the concrete water table and base of the main hospital building was given special consideration in an effort to produce a richly textured surface of colored aggregate. The effect was to be achieved by a method of bond transfer from form liners surfaced with the colored aggregate before placing; however, this proved to be impracticable under wartime conditions. The final design calls for these surfaces to be formed with rough-sawn lumber so that when the forms are removed the coarse grain of the wood and the joints will be exposed. The local stone aggregate, which normally has a wide and uncertain range of color, is being specially selected for this purpose.

With the exception of cement, concrete aggregates and reinforcing steel, the only materials available locally are concrete block and cement brick, necessitating the shipment of virtually all required material from the mainland. To meet construction schedules, many of the prefabricated items were detailed and purchased well in advance of completion of working drawings. In scheduling the ordering of these materials careful attention had to be given to their priority in construction sequence, to the time required for fabrication and to the fact that their shipment would coincide with heavy movements of other, more vital, material into the Pacific theater. Because of the urgent need for a hospital of this character and capacity in the Pacific area, every effort is being made to expedite its completion, which is scheduled for January, 1947.

Architects and engineers

Plans were prepared in the office of York and Sawyer, architects, New York City, under the supervision of the Office of the Chief of Engineers and of the Surgeon General of the Army. Paul Philippe Cret of Philadelphia was associated with York and Sawyer as consulting architect on the project.

Structural engineering design was under the direction of Fred N. Severud, consulting engineer, New York City. Myer, Strong and Jones of New York are the consulting electrical engineers, while Fred L. Moesel of New York is the consultant for the steam supply system, ventilating and air conditioning.

Construction is being directed by York and Sawyer under an architect-engineer-management contract with the supervision of the U. S. District Engineer at Honolulu, T. H. Field design of column footings is under the direction of E. G. Elstad.

Economical Sizes of Water Pipe

C. S. Reagan
Designing Engineer, Myers and Noyes, Consultants
Corpus Christi, Texas

AN OVERALL STUDY of water main and pumping costs in Corpus Christi, Texas, has revealed a logical and analytical determination of economical pipe sizes. Waterworks men of long experience usually select the size of main according to the average rate of flow to be carried, but we find the choice can be made much more accurately from a study of the cost of pipe in place, pumping rates and power costs.

Obviously, there is a certain cost involved in owning a thousand feet of pipe in place. This cost is made up of the original construction cost, the expected life of the main, and the rate of interest on construction bonds. The estimated cost of ownership is shown for various pipe sizes in the accompanying table, based on 1943 construction and pipe costs for cast iron mains in Corpus Christi.

Final costs include pumping

The selection of the economical size of pipe is based finally on the cost of pumping through the main. In arriving at the cost of pumping, we consider: (1) rate of flow for each month as a percentage of the yearly average flow; (2) friction loss per 1,000 ft. of pipe; and (3) cost of power. In our city we find the monthly proportion of the average yearly pumping rate is as follows:

Month	Percent Ann. Aver.	Month	Percent Ann. Aver.
Jan.	89	July	117
Feb.	91	Aug.	131
Mar.	93	Sept.	111
Apr.	96	Oct.	92
May	101	Nov.	87
June	106	Dec.	86

Friction loss was computed using C=100 in the Williams and Hazen formula. Power cost was based on an assumed overall efficiency of 75 percent and a current rate of 1 c. per Kwh.

Based on these data, the economical size of mains from 4 in. to 24 in. has been determined as shown in the accompanying chart. It is interesting to note that the limiting velocity in the various sizes is about the same, varying from 2.5 to 2.9 fps.

While these cost figures are based on construction costs and cost of pipe in Corpus Christi, and on cast iron mains, the same principles can be applied to other locations and to other pipe materials.

COST OF CAST IRON WATER MAINS, CORPUS CHRISTI, TEXAS

Size Pipe, in.	4	6	8	10	12	16	20	24
Trench: Width, in.	20	22	22	24	26	30	34	36
Depth, in.	52	54	56	58	60	64	68	72
Excav., c.y. per ft.	0.27	0.30	0.32	0.36	0.40	0.49	0.59	0.67
Lab. & Mat. cost per ft.:								
Trench and backfill, @ $1.50 cu. yd.	$0.41	$0.45	$0.48	$0.54	$0.60	$0.74	$0.89	$1.00
Haul pipe	.03	.04	.05	.06	.07	.08	.10	.12
Lay pipe	.06	.09	.12	.15	.18	.24	.30	.40
Cost of pipe	.86	.90	1.35	1.74	2.21	3.24	4.56	6.07
Joint material	.03	.04	.05	.06	.07	.09	.11	.13
Overhead, profit	.16	.23	.31	.38	.47	.66	.89	1.16
Sub-total	$1.25	$1.75	$2.36	$2.93	$3.60	$5.05	$6.85	$8.88
Repl. 6-in. shell pave. @ $2.50 c.y.	.08	.08	.08	.09	.10	.12	.13	.14
Total cost per ft.	$1.33	$1.83	$2.44	$3.02	$3.70	$5.17	$6.98	$9.02
Cost per 1,000 ft. pipe	$1,330	$1,830	$2,440	$3,020	$3,700	$5,170	$6,980	$9,020
Fittings @ 10 percent	133	183	244	302	370	517	698	902
Total	$1,463	$2,013	$2,684	$3,322	$4,070	$5,687	$7,678	$9,922
Est. life, yrs.	50	65	75	75	100	100	100	100
Ann. cost per 1,000 ft. Amortized @ 3.5 percent	$62.37	$78.88	$101.64	$125.80	$147.17	$205.64	$277.63	$358.77

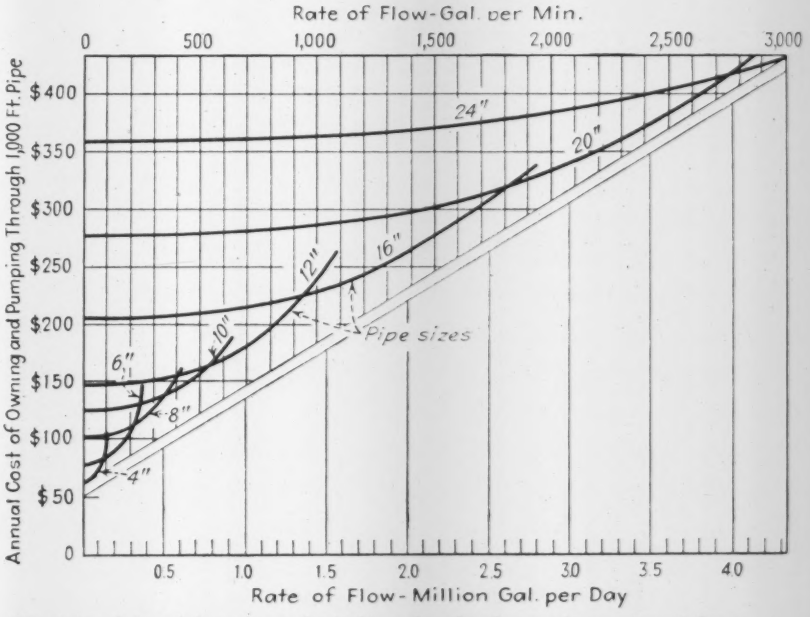


Chart for determining economical sizes of mains for various rates of flow.

Hankinson Formula Applications For Stresses at Timber Joints

F. C. Smith
Associate Professor of Civil Engineering
University of Washington, Seattle, Wash.

THE HANKINSON FORMULA, now commonly used to determine the allowable stresses in timber joints, is not the original one but is a modified type of the original formula. The writer had occasion recently to make a critical examination of both the original and modified formulas and feels that, even though the present formula has been in use for some years, a further modification is desirable as the allowable stresses obtained from the version presently used are too low.

The original Hankinson formula is an empirical one derived from the result of tests made in 1921 by the Army Air Service on spruce for airplane construction and reported in Army Air Service *Circular* No. 259.

The tests were made on a 2x2 in. specimen 6 in. long. The load was applied over 4 sq. in. of the specimen by means of a bearing plate in a manner similar to the standard test for compression parallel to grain, except that instead of the grain being at 90 deg. to the direction of the load, it made varying angles with that direction. Tests were made at angles of 0, 3, 6, 10, 15, 20, 30, 45, 60, 70, and 90 deg. When the data were plotted, it was found that a line passed through the points was a reverse curve and that the formula

$$n = \frac{P\,Q}{P \sin^2\theta + Q \cos^2\theta}$$

was the equation of a curve that approximated the average line. In this

- n = unit bearing (compressive) stress at angle θ
- p = unit bearing stress when angle θ is zero
- Q = unit bearing stress when angle θ is 90 deg.
- θ = angle between direction of applied force and direction of grain.

That P, Q, and n are the stresses at failure is evident from the article.

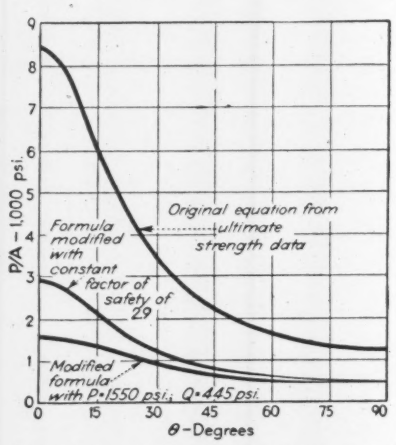
Several items should be noted in connection with this formula:- First, that n, P, and Q are ultimate stresses, and, second, that P, the ultimate stress parallel to the grain is the bearing strength of a 2 x 2 x 6-in. block loaded on a 4 sq. in. section of one of the 2 x 6-in. faces, not a 2 x 2 x 8-in. block loaded on the ends, altho tests made at the same time seem to indicate there is little difference between the two values. Third, that it is an empirical formula applicable only to certain conditions.

Now what has happened to the formula?

In the *Wood Handbook* prepared by the Forest Products Laboratory (p. 57) and in *Directive* 29 of the War Production Board (p. 23) is given a formula that is called the Hankinson formula. On page 29 of the directive is shown its application to a particular type of joint. (The same information appears in *National Design Specifications for Stress-Grade Lumber and its Fastenings* recently published by the National Lumber Mfg. Assoc., Washington 6, D. C.) The formula in these articles is identical in form with the original Hankinson formula, but the terms are defined as follows:

- n = *allowable* unit stress perpendicular to an inclined surface.
- P = *allowable* unit stress parallel to the the grain.
- Q = *allowable* unit stress perpendicular to the grain.
- θ = angle between direction of the load and direction of the grain.

In the sample application P is taken as 1,550 psi. and Q as 445 psi. What has happened is that P, Q, and n, which were ultimate *bearing* stresses in the original formula, have become —P, the *allowable compressive* stress on a short column, (L over D equal or less); Q the *allowable* bearing stress at 90 deg. to the grain; and n the *allowable* stress when the grain makes an angle θ with the direction of the load. This would not be particularly objectionable if the allowed stresses based on stresses parallel to grain had the same factor of safety as those perpendicular to the grain; but they do not. If allowable stresses as given in the WPB Directive are compared with the original test data, it is found that the factor of safety for P is 5.6 and for Q is 2.9. A curve showing values from this formula is plotted below with the original data.


P/A - 1,000 psi.
θ-Degrees
Formula modified with constant factor of safety of 29
Original equation from ultimate strength data
Modified formula with P-1550 psi., Q-445 psi.

Suggested modifications of the Hankinson formula plotted with the original.

There is a good reason for having different factors of safety for the compressive stress on a short column and for the bearing stress perpendicular to the grain. The loading parallel to the grain is usually on members in which the load is applied parallel to the long axis of the member and failure is by buckling of the piece as a whole or by buckling of the individual fibers and such failure involves the whole member. In loading perpendicular to the grain, the so-called failure is a local crushing at the bearing surface and, while objectional, does not involve the whole member.

It would seem that if 2.9 is a sufficient factor of safety for bearing at 90 deg. with the grain (remembering that the formula is for bearing stress only) that 2.9 would be sufficiently high for bearing at 75 deg., 60 deg., or any other angle and the formula written as follows:

$$n = \frac{P\,Q}{(\text{“}f\text{”})\,(P \sin^2\theta + Q \cos^2\theta)}$$

- n = allowable bearing stress.
- P = *ultimate* compressive stress parallel to grain.
- Q = *ultimate* compressive stress perpendicular to grain.
- “f” = factor of safety.

Values obtained from this formula, using a factor of safety of 2.9, are plotted with the other two curves. Even if one is not willing to accept the premise that there should be a constant factor of safety for bearing stress, it is the author's opinion that all will agree that there should be some more rational method of determining the allowable bearing stresses other than arbitrarily choosing the values of P, and Q.

Economist Places Construction High in the National Economy

THE CAPITAL GOODS INDUSTRIES play a peculiarly important role in our society, according to Alvin H. Hansen, professor of political economy at Harvard University, and within the general scope of the capital goods industries, the construction industry is an enormously important section. These statements were made by Dr. Hansen at a dinner of the American Road Builders' Association held in Washington recently.

"It is an over-statement and something of an over-simplification, but I think it is to a large extent true that the capital goods industries, and to some considerable extent the construction industry within that larger category, call the tune and determine in very large measure whether we have good times or bad times, and determine to a very large extent whether we have a high level of employment and how stable that level of employment is."

Construction after World War I

Looking back at the years following the last war, Dr. Hansen said further: "The thing that in my judgment helped to make the depression of 1921 and 1922 short lived and enabled us to get out of it very rapidly was the role of construction. Construction was running along in the two years 1919 and 1920 at a pretty high level.

"New construction was running along at a level of a little over six billion dollars on the average in those two years, and if you add in maintenance, it was running along at the level of 8.5 billion dollars. When you consider that the national income at that time was something like half or less than half of the comparable employment income level today, with the growth of something like a half that has taken place in productivity and the labor force, if construction plays the same role in the first two years after this war that it played after World War I, it would mean in terms of new construction, let us say, a volume of something like 12 billion dollars a year in each of the first two years. If you add maintenance, it would be something like 17 billion dollars in each of the first two postwar years.

"Considering the fact that we are starting from a very low level of construction in the last war year, I doubt that there is anybody who believes that this time we shall be able to reach a volume of construction relative to the size of our economy today in the first two years after the war that would compare with the volume of construction we had in 1919 and 1920.

High employment after 1921

"The combined effect of the rise in automobile purchases that occurred then and the related impact of that upon a vast number of industries, plus the growth in construction, are major factors that explain the relatively short duration of the depression in 1921 and show why we went on in a very strong way toward a high level of income and employment such as we enjoyed from 1922 to 1929.

"I think it is also perfectly clear that one of the major reasons why we had such a sustained volume of high level of income and employment in the Twenties was the very high level of construction in that period. In the good years of new construction we had a volume of public and private construction between 11 and 12 billion dollars, and a very sustained level on through 1923 to 1929. If you add maintenance, the volume was somewhere around 14 billion dollars.

Decline in capital outlays

"From 1929 to 1932 we had a decline in private capital outlays at the rate of 15 billion dollars per annum. When that decline occurred, you had not a fall in income of 15 billion dollars but of something approaching 45 billion dollars.

"If private capital outlays are continued at the level of 17 billion dollars, as they were in the high years of the Twenties, I think you can be almost sure that the volume of consumption expenditures would have continued at the high level at which it was running in the Twenties. I think it follows, therefore, that a major problem of modern society is the problem of successfully finding a high volume of outlet for savings, a high and stable volume of capital outlay, of investment, of which construction plays a very important, and indeed a major role.

"If we try to set for ourselves the goal of stabilizing the construction industry on a high level, I think it becomes a more manageable and feasible task than it would to try to make the construction industry act as the complete balance wheel for the entire economy."

The place of roadbuilding

In the discussion that followed his talk, Dr. Hansen was asked by Charles M. Upham, engineer-director of the American Road Builders Association, about the place of roadbuilding in the general construction field. To this Dr. Hansen replied that he thinks that roadbuilding is one of the very good fields that could be fluctuated countercyclically in stabilizing the construction industry.

In presenting his question, Mr. Upham had suggested the figure of $15 billion for the annual amount of new construction in the postwar period. As to this, Dr. Hansen said, "I have the feeling that if we are going to have a high level of employment in the postwar years, we will need more, nearly 18 billion dollars of construction a year, and if you add in maintenance, it would be up toward 22 billion of construction, private and public. That is roughly in proportion to the total volume of construction, new and maintenance, that we have had in the past, when you consider the growth that has taken place in our economy in productivity and in manpower."

Sustained high rate needed

Asked further by A. E. Paxton, publisher of *Engineering News-Record*, whether his $18 billion figure was a maximum, or whether it was a figure that he hoped could be attained over a long period of time, Dr. Hansen replied, "It is the kind of figure that we ought to aim to maintain. We ought to set a figure that we could maintain over a considerable period. Maybe it is too high. I wouldn't want to be rigid about it, but I think, as far as I can figure it out, it ought to be something in the neighborhood of 15 or 16 to 18 billion a year of new construction plus major repairs, but not including maintenance."

Fig. 1. Small basins were rimmed with pontoon cells to provide ship berths when floating wharves were destroyed.

Pontoon Cells Form Slips For LST's

N. A. Bowers
Pacific Coast Editor,, Engineering News-Record

PONTOON CELL WHARVES, so widely used in the Pacific theater of operations, have many advantages in addition to the speed with which they can be made ready for service. A serious shortcoming, however, is the necessity for a hinged connection at the inshore end. This joint is a weak spot in the structure, and if the wharf is in an exposed location the joint may be broken under the continual strain and impact of heavy waves.

To meet that situation at Emirau Island in the St. Matthias group, ingenious Seabees dredged small basins or slips in a previously filled area on a coral reef and rimmed them with strings of pontoon cells salvaged from the floating wharves, thus providing a relatively sheltered berthing space without making use of any hinged joint. It is believed that this idea, developed here in an emergency, may be useful at other locations and quite possibly for larger craft.

When the Seabees came ashore on Emirau the water on the lee side of the island was continuously smooth and remained calm even when waves were breaking on the opposite or windward shore. A coral fill was made, about 450 ft. wide, extending from the shore to the edge of the coral reef some 300 ft. out. From the outer edge of this fill four floating wharves were extended into deeper water.

To provide for tidal fluctuations, which ranged up to about 3.5 ft., these wharves were designed to hinge along the line of contact with the beach. Two rows of cells at the beach end of each wharf were filled with water to increase stability and as anchorage steel cables extended back to deadmen buried some distance inshore.

Waves broke up floating piers

Later in the year when the season changed, so did the prevailing winds and what had previously been a lee shore became habitually rough. Waves 2 ft. high are sufficient to cause rather serious movement in the hinge of the floating wharves. Seas higher than this came in frequently and occasionally 4- or 5-ft. waves would break over the floating wharves. In the en... though fortunately not before subst... tute berthing space had been pr... vided, all four of the floating pie... were broken up or torn loose by wa... action.

When it became apparent that flo... ing wharves here would be costly t... maintain at best and were probabl... an impractical type of construct... for this location, it was decided t... construct slips or basins in the fill... area. Each slip was to be lar... enough for docking two LCTs. Wi... this facility the craft would have rel... tively sheltered berths and the ob... jectionable features of the expos... floating wharves would be eliminate... The first slip was so successful th... two more were put in, thus provid... berths for six landing craft.

In constructing the slips, whi... were made 80 ft. wide and 120 ... long, the first operation was to e... cavate the fill material in the slip ar... and then to drill the hard coral re... formation beneath. A 4½-in. rota... deep well drill rig was used and hol... on 6-ft. centers both ways were p...

down throughout the area of the slip to a depth of about 2 ft. below the grade desired. The perimeter of the slip was line drilled on 18-in. centers and these holes were loaded with small charges by way of insuring a fairly vertical face along the edges of the slip.

Drilling in the approach channels was done from the floating wharves, for the most part working the drill between the pontoon cells. A drill rig in operation on one of the floating wharves is shown in Fig. 2. In the hard reef formation it was found that 1 lb. of dynamite per cubic yard of coral was about right.

Backhoe used for excavating

Blasting was done first in the outer rows of holes to afford the maximum use of undisturbed area for removing spoil. Excavation was done chiefly with a 1½-yd. backhoe which was well adapted for the "back up" procedure that permitted working on shore.

Each slip required the removal of about 3,500 cu.yd. of material, of which the upper portion was the relatively soft fill and the lower 1,800 cu.yd. was the hard coral of the underlying reef. A ¾-cu.yd. shovel was used as an aid to the backhoe where this could be done to special advantage.

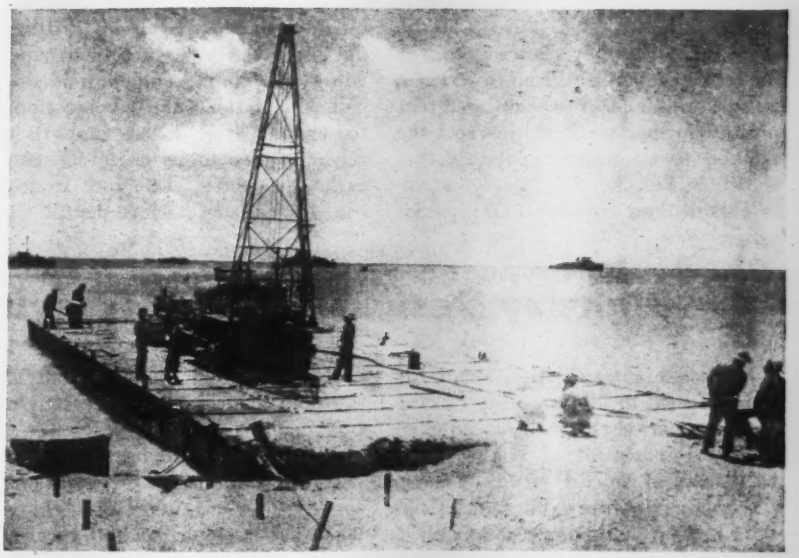


Fig. 2. Floating wharves, like this, made of pontoon cells and having a "hinged" connection at the inshore end, could not long withstand high waves.

Each slip was rimmed with pontoons salvaged from the floating wharves. The strings of these pontoons were placed at a grade such that their tops were level with the surface of the adjoining fill which came up to their inshore edges. Holes were burned in the deck plates of the cells to permit of filling them with sand to eliminate buoyancy.

Several different methods of supporting and fastening of the pontoon strings rimming the slip rim were considered. One was to drive 8-in. pipes along the water face of the cells and

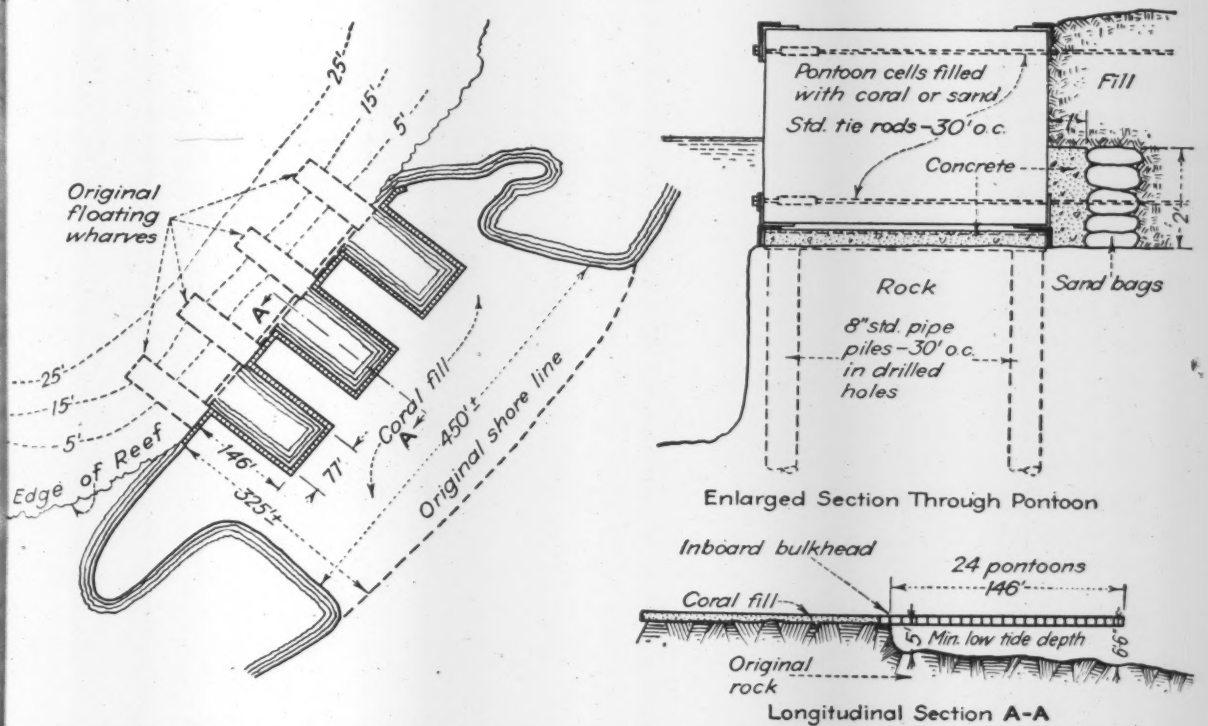


Fig. 3. Plan of the filled area where wharves and, later, slips were built. The section shows preferred pipe support for cells.

Fig. 1. Small basins were rimmed with pontoon cells to provide ship berths when floating wharves were destroyed.

Pontoon Cells Form Slips For LST's

N. A. Bowers
Pacific Coast Editor,, Engineering News-Record

PONTOON CELL WHARVES, so widely used in the Pacific theater of operations, have many advantages in addition to the speed with which they can be made ready for service. A serious shortcoming, however, is the necessity for a hinged connection at the inshore end. This joint is a weak spot in the structure, and if the wharf is in an exposed location the joint may be broken under the continual strain and impact of heavy waves.

To meet that situation at Emirau Island in the St. Matthias group, ingenious Seabees dredged small basins or slips in a previously filled area on a coral reef and rimmed them with strings of pontoon cells salvaged from the floating wharves, thus providing a relatively sheltered berthing space without making use of any hinged joint. It is believed that this idea, developed here in an emergency, may be useful at other locations and quite possibly for larger craft.

When the Seabees came ashore on Emirau the water on the lee side of the island was continuously smooth and remained calm even when waves were breaking on the opposite or windward shore. A coral fill was

over the floating wharves. In the e... though fortunately not before subst...

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down throughout the area of the slip to a depth of about 2 ft. below the grade desired. The perimeter of the slip was line drilled on 18-in. centers and these holes were loaded with small charges by way of insuring a fairly vertical face along the edges of the slip.

Drilling in the approach channels was done from the floating wharves, for the most part working the drill between the pontoon cells. A drill rig in operation on one of the floating wharves is shown in Fig. 2. In the hard reef formation it was found that 1 lb. of dynamite per cubic yard of coral was about right.

Backhoe used for excavating

Blasting was done first in the outer rows of holes to afford the maximum use of undisturbed area for removing spoil. Excavation was done chiefly with a 1½-yd. backhoe which was well adapted for the "back up" procedure that permitted working on shore.

Each slip required the removal of about 3,500 cu.yd. of material, of which the upper portion was the relatively soft fill and the lower 1,800 cu.yd. was the hard coral of the underlying reef. A ¾-cu.yd. shovel was used as an aid to the backhoe where this could be done to special advantage.

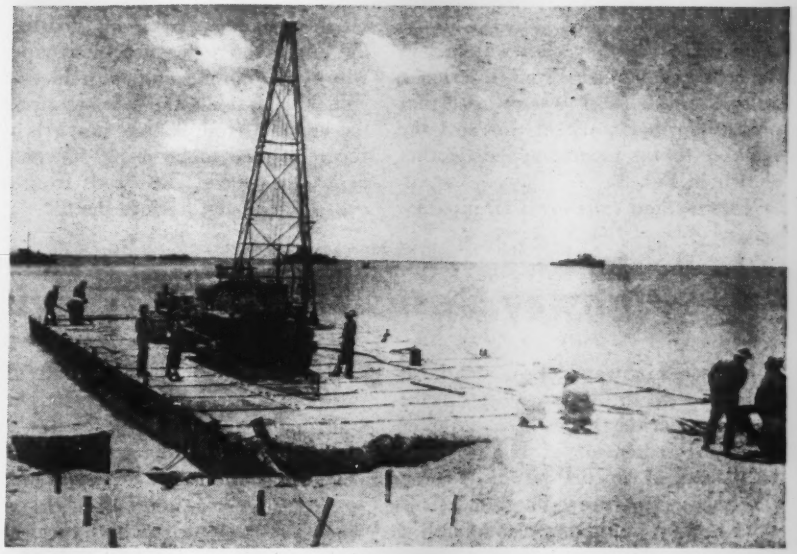

Fig. 2. Floating wharves, like this, made of pontoon cells and having a "hinged" connection at the inshore end, could not long withstand high waves.

Each slip was rimmed with pontoons salvaged from the floating wharves. The strings of these pontoons were placed at a grade such that their tops were level with the surface of the adjoining fill which came up to their inshore edges. Holes were burned in the deck plates of the cells to permit of filling them with sand to eliminate buoyancy.

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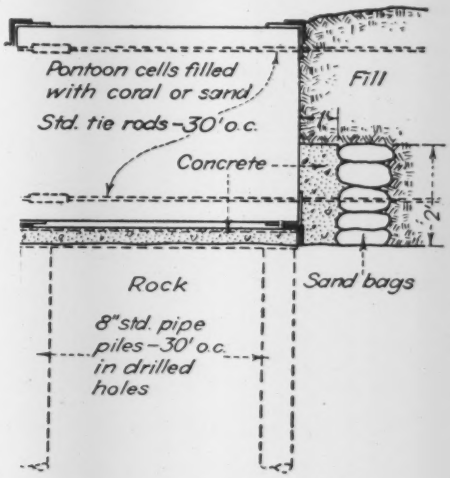
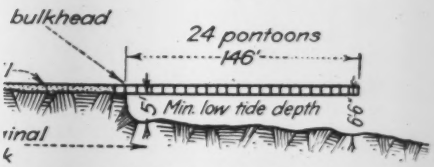


ged Section Through Pontoon



Longitudinal Section A-A

ction shows preferred pipe support for cells.

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weld them to the cell plates, thus providing fastening and support at the same time. Another plan was to bed the cells in concrete. From experience gained on this job it was decided that on any further work of this sort the method to be recommended is that shown in Fig. 3.

This method calls for 8-in. pipe put down in holes drilled with an 8-in. bit in the rotary rig used in drilling the slip. The pipes are then capped with two 6x6-in. angles welded together to simulate the cross-section of the channel iron. These supports are recommended to be on 30-ft. centers as are also the steel tie rods from the cells to deadmen back in the fill.

The design for these sl[illegible] was worked out and the first slip [illegible] was built by the 27th Naval Construction Battalion under Comdr. Willard G. Tries officer in charge. Later, two more slips, duplicating the first, were built by the 77th Naval Construction Battalion, Comdr. Charles T. Wende officer in charge.

Highway Design Standards Revised in Louisiana

Revised highway design standards to be applied to highways built in the postwar period have been adopted by the Department of Highways in Louisiana, of which Harry B. Henderlite is chief engineer. The new standards are given in the accompanying table.

Highways in the state are divided into five classes, based on anticipated traffic volume, and these classes are subdivided into urban and rural to permit variations in the requirements for speed, curvature and sight distances between urban and rural sections having similar traffic densities.

To facilitate application of the new standards, a new highway map of the state has been prepared showing the Class I, II and III highways. Classifications for this map were prepared by increasing by 50 percent the traffic volume found in the 1941 traffic survey.

DESIGN STANDARDS FOR RURAL AND URBAN HIGHWAYS—STATE OF LOUISIANA

ITEMS	CLASS I		CLASS II		CLASS III		CLASS IV		CLASS V	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
1. Anticipated Future Traffic Range (Daily)	5,000 or more		5,000–3,000		3,000–500		500–150		150 or less	
2. Number of Traffic Lanes (Min.)	4		4		2		2		2	
3. Width of Each Lane	12′		12′		12′		10′		9′ to 8′	
4. Width of Shoulders (Min.)	10′		10′		8′		6′		5′	
5. Width of Median	40′ (Minimum)		30′ (Minimum)							
6. Surface Type	High Type Pavement		High Type Pavement		Dustless Treated or High Type Pavement		Gravel, Shell or Dustless Treated		None, Gravel or Shell	
7. Speed Design (m.p.h.)	75	50	75	50	75	50	60	30		
8. Side Slope (Ratio)	4:1 To 6:1*		4:1 To 6:1		4:1 To 6:1		3:1		3:1	
9. Back Slope (Ratio)	3:1		3:1		3:1		3:1		3:1	
10. Width of Bridges Less Than 100′ Long	Unrestricted Roadway		Unrestricted Roadway		Unrestricted Roadway		Unrestricted Roadway		18′	
11. Minimum Width of Bridges 100′ to 500′ Long	2 At 30′		2 at 30′		30′		24′		18′	
12. Minimum Width of Bridges Over 500′ Long	2 At 26′		2 At 26′		28′		24′		18′	
13. Bridge Loading	H-20-S-16 (Br. Less Than 100′) H-20 (Br. 100′ Span or Greater)		H-20-S-16 (Br. Less Than 100′) H-20 (Br. 100′ Span or Greater)		H-20-S-16 (Br. Less Than 100′) H-20 (Br. 100′ Span or Greater)		H-15		H-10	
14. Controlling Grade (Max.)	3½% or 5%		3½% or 5%		5%		5%			
15. Controlling Curvature (Max.)	3°	7°	3°	7°	3°	7°	6°	17°		
16. Sight Distance — Non Pass, Pass-Vert. & Hor. (Min.)	800′ 4½′ To 4″	400′	800′ 4½′ To 4″	400′	800′ 4½′ To 4″	400′	525′ 4½′ To 4″	200′		
17. Sight Distance — Passing Vert. And Hor. (Min.)	800′ 4½ To 4″	400′	2,600′ 4½′ To 4½′	1,500′	2,600′ 4½′ To 4½′	1,500′	2,200′ 4½′ To 4½′	500′		
18. Clearance Vertical (Min.)	15′		15′		15′		15′		15′	
19. Clearance Hor.-Other Than Bridges (Min.)	Unrestricted Roadway		Unrestricted Roadway		Unrestricted Roadway		Unrestricted Roadway		18′	
20. Right-of-way Widths (Min.)	300′		200′		120′		100′		60′	
21. Traffic Volume Required Grade Separation	All Intersecting Highways		1,000 Vehicles on Intersecting Highways	None Required	None Required		None Required		None Required	
22. Traffic Vol. Required RR.-HWY. Separation	All Except Minor Spur Tracks		All Except Minor Spur Tracks	Warning Light & Bell	Where Exposure Factor is 5,000 or Greater	Warning Light & Bell	Warning Light and Bell		None Required	
23. Access	Restricted		Partially or Wholly Unrestricted		Unrestricted		Unrestricted		Unrestricted	

*8. Generally, 6:1 slopes are to be limited to embankments under 5-ft. high.

From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

Addition of Numbers with Mixed Signs Simplified

One of the problems occuring more or less frequently in an engineering office is that of adding a series of quantities involving both positive and negative numbers. A relatively easy method of performing this operation follows:

Assume that the sum of the following quantities is to be obtained, the total of which is 1221: + 826 — 285 + 924 — 497 + 253.

Beginning with an arbitrary multiple of 10, in this case 20, add up the units column with due regard to the sign; thus 20 + 3 — 7 + 4 — 5 + 6 = 21, the units digit 1 being recorded in the usual manner, and leaving the tens digit 2 to be carried into the next column. In adding up the tens column, it is to be noted that the amount that has been carried over already contains the 2 in the tens place of the initial 20, so that by adding an additional 18 an excess of 20 will be used in adding up the tens column. This addition is: 2 (carried over + 18 + 5 — 9 + 2 — 8 + 2 = 12, giving the tens digit of the result and a carry over into the hundreds place. Another 18 is added and the column totaled up to 32. Since this includes an excess of 20, that amount is dropped leaving the total of 1221.

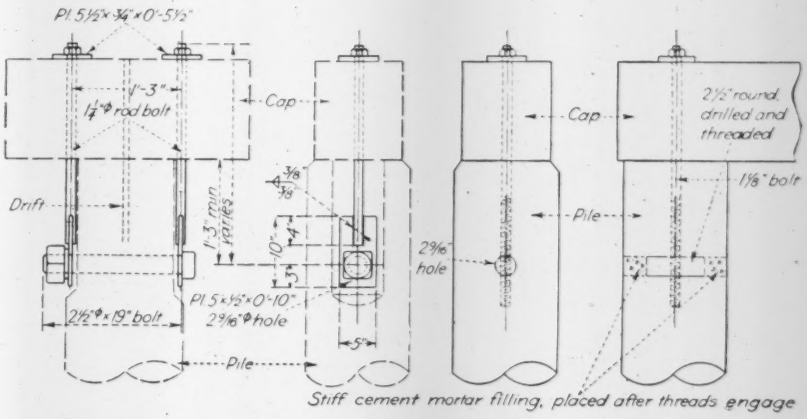
Had the final figure been less than 20 it would have indicated a negative result, which could have been obtained by taking the difference between 2000 and the result actually obtained. However, it is frequently possible to anticipate a negative result and to perform the computation as if all the signs were reversed.

THOMAS C. COLEMAN
Junior Civil Engineer
Massachusetts Dept. of Public Works
West Somerville, Mass.

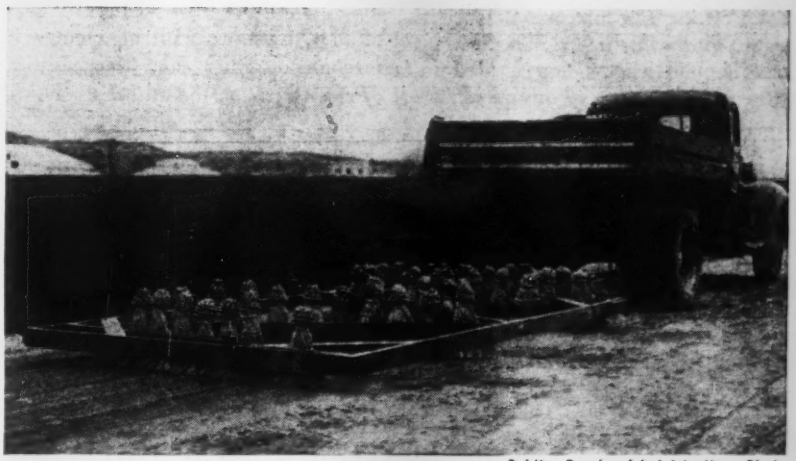
How to Tie Down Pile-Caps

Uplift gets attention in the design of wharf structures, particularly in the joint between pile top and cap, because of vertical components that may be transmitted by batter piles when a ship thrusts against the fender piles in docking. As these batter piles bear against the underside of stringers bolted to the cap, the vertical component of thrust puts the pile-cap joint in tension. A similar upward pull sometimes is caused by mooring lines at high tide. There are numerous instances of caps having been pulled entirely off the piles from these causes.

To provide a reasonable amount of resistance to such uplift various details in the pile-cap connection have been devised. The two shown in the accompanying drawing are both used extensively on the Pacific Coast; the one with the cement mortar filling (shown at right in drawing) was developed by the California State Harbor Commission and the one at left by the A. W. Earl organization. The mortar used in the first type is desirable to avoid risk of limnoria attack at a point where the creosote protection has been cut away. This second design has become popular for its strength and ease of assembly.



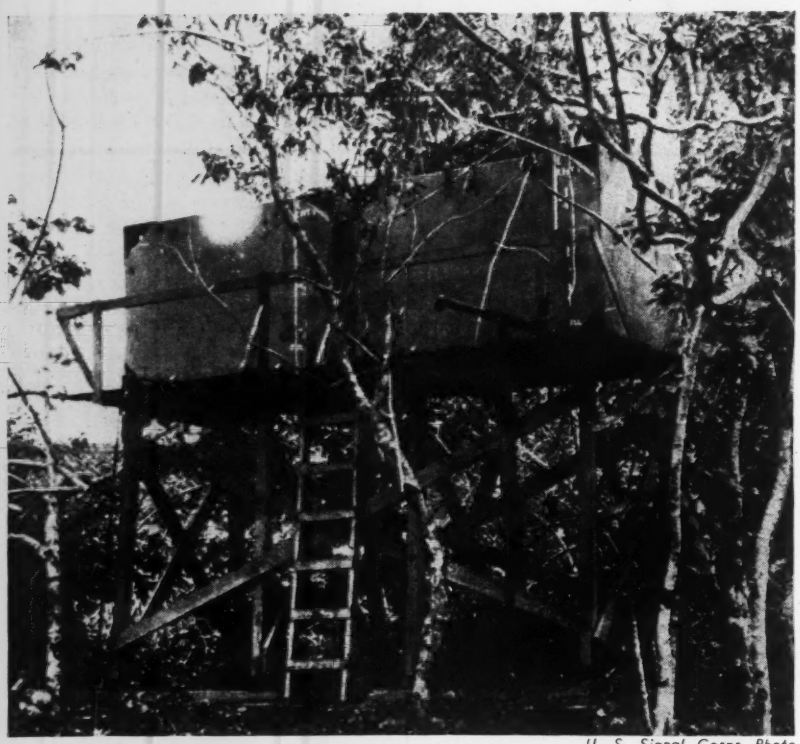
Two means of resisting forces that tend to lift a cap from a pile.



Public Roads Administration Photo

SOUTH AMERICAN STYLE OF ROAD DRAG

Engineers maintaining a road near Bogata, Colombia, found the drag pictured above a helpful tool. The bristles were made of local street brooms.



U. S. Signal Corps Photo

STEEL PONTOONS USED AS ELEVATED WATER TANKS

On a Pacific island two steel pontoons of the type proving so useful to the Navy's Seabees are being used as an elevated water tank. Operations have shown the cells highly suitable for this purpose as they are quickly erected, provide covered storage, and if changing conditions so dictate they may be taken down and readily moved ahead.

Bulldozers Work in the Sea

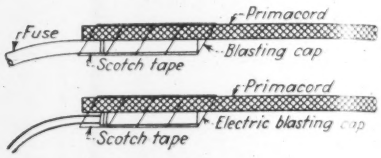
Amphibian landing strips out in the Pacific are often made by bulldozer and scraper operations at low tide working the material to desired grade, after which (1) Marston mat may be laid after being welded together while supported on the surface by floats, (2) concrete paving may be placed with tremies or (3) the 2x2x¼-in. wire mesh may be put down with or without concrete. In these operations bulldozers work in water depths of 3 ft. or more with no change in mechanism other than the addition of riser pipes on the oil breathers.

Bulldozers and scraper grade the subaqueous portion of an amphibian landing strip. Note foreman wading shoulder-deep.

Scotch Tape Speeds Connection And Saves Copper in Blasting

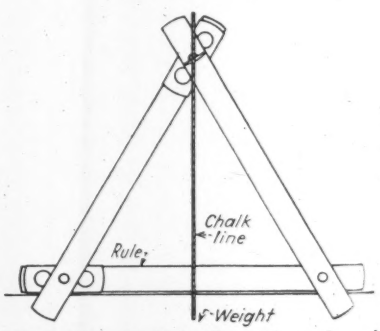
The scarcity of war needed copper and the search for a more speedy means of connecting either electrical or fuse detonated caps to detonating cord has led to the elimination of the copper unions, once considered absolutely essential, and the substitution of the taping method for attachment.

As the accompanying diagram indicates the cap is laid parallel to the detonating cord with the charged end in the direction that the detonating cord will detonate because the blasting cap may cut the detonating cord and thereby prevent it from detonating in the opposite direction. That this is true is often demonstrated by the fact that after some blasts the rearward section remains unexploded.



The cord at the point of attachment should be quite dry to insure detonation and under no circumstances should any turns of tape be permitted between the cap and the cord. The binding of reinforced Primacord must be stripped back before taping the cap to the cord. Two turns of Scotch tape around the point of attachment will make a joint that is mechanically perfect in every respect.

—Paul C. Ziemke, *Oak Ridge Tenn.*



Carpenter's Rule Serves as Level

When out in the field and in need of a level with none at hand, an ordinary carpenter's rule serves nicely when unfolded partially to form a V or triangle from which a weighted string is suspended at the apex. When the cord is at right angles with the base, or lower section of the rule, the material the rule is rested on is reasonably plumb.—Paul C. Ziemke, Oak Ridge Tenn.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Steel Design

SIMPLIFIED DESIGN OF STRUCTURAL STEEL—Harry Parker. 226 pp. John Wiley & Sons, New York 16. $2.75.

Fourth in a series of elementary books dealing with structural design, this volume covers the design of the most common structural steel members that occur in building construction and illustrates the practical application of engineering principles and formulas. Derivations of the most commonly used formulas and essential tables have been included. Earlier texts in the series cover reinforced concrete, roof trusses, and simplified engineering principles and data for architects and builders.

Postwar Expenditures

POSTWAR FISCAL REQUIREMENTS: Federal, State and Local—by Lewis H. Kimmel and associates. The Brookings Institution, Washington, D. C. $2.

Estimates of what federal, state and local governments will spend on construction in the postwar years are given in this discussion of the fiscal requirements at various levels of government during that period. Starting the 1940 expenditures as a base, the authors have undertaken to determine what expenditures by public agencies will be in 1949, using trends or actual legislation as a guide in reaching the postwar estimates. They break down their 1949 figures into maximum, minimum and probable.

Architectural Trends

BUILDING TODAY—By Martin S. Briggs. 112 pp. Oxford University Press, London and New York. $2.

Refreshing is the best way to characterize this little book by a British architect, which is one of a series on modern scientific development called the "Pageant of Progress." The author is writing about buildings in the British Isles, but many of his observations about architectural styles and building details will be found to be applicable the world over. He states, for example: "In their worship of ships and aeroplanes some of the hot-gospellers of modernism have spoken of 'clean *swift* lines' in architecture, whereas the prime function of a building is to be static. Keep its lines 'clean' by all means, but the streamlining of a house is certainly not functional."

American readers will find food for thought in many of the author's observations.

Organized Thinking

HOW TO SOLVE IT—G. Polya. 204 pp. Princeton University Press, Princeton, N. J. $2.50.

Written simply and concisely, this study of methods of solving problems pays special attention to the requirements of students and teachers of mathematics, but it should interest those concerned with the ways and means of invention and discovery. It deals with "the procedures of the mind in searching for solutions of problems—procedures that are naturally followed by the common man in his moments of concentration and are continually practiced by men of talent."

A Textbook on Estimating

BUILDING CONSTRUCTION ESTIMATING—By George H. Cooper. 282 pp. McGraw-Hill Book Co., Inc., New York 18 and London. $3.

A textbook for technical and vocational schools prepared from material used in the author's classes at Mechanics Institute, New York. In addition to estimating, the book explains the functions and relations of the architect, contractor and owner and discusses the types of contracts with the advantages and disadvantages of each.

Chapters are devoted to an explanation of the various building materials while excellent illustrations name every part of the structure for the education of the novice. The text covers briefly the quantity survey and means for determining costs. It also discusses the items of general overhead that must be included in a bid. The book is not a handbook for an experienced estimator, and students will find in actual practice that they will need more detailed information on translating information about materials into accurate estimates of the actual cost of putting them into place.

Surveying Text Revised

ELEMENTARY SURVEYING—Volume I of The Principles and Practices of Surveying. Eighth Edition. By Charles B. Breed and George L. Hosmer. 717 pp. John Wiley & Sons, New York 16; Chapman & Hall, London $4.

In the eighth edition of this well-known text on surveying the chapter on public lands surveys has been completely rewritten to give appropriate recognition to changes that have occurred since that chapter was largely rewritten in 1931. Astronomical tables have been brought up to date and other minor changes have been made.

Cities of the Future

NEW ARCHITECTURE AND CITY PLANNING—A Symposium edited by Paul Zucker. 694 pp. Published by the Philosophical Library, 15 E. 40th St., New York. $10.

CITY DEVELOPMENT: Studies in Disintegration and Renewal—By Lewis Mumford. 248 pp. Harcourt, Brace & Co., New York 17. $2.

These two books are made up of essays, the first by about 60 different authors and the latter by one man over a period of 20 years. The subjects covered in New Architecture and City Planning go far beyond either architecture or city planning, reaching out to topics such as "ocean liners of the future" the "architecture of inland waterways." Almost of necessity when so many subjects are covered in one book, much of the treatment is superficial. The quality ranges from visionary to practical.

Mumford's essays are more directly centered on his basic theme, redevelopment of our cities for better living. In his opinion, our civilization is as out of date as are most of our cities. The period of expansion is over, he states, and "the great urban masses created by that period are bankrupt... Good planning, in the postwar age,

will rest on the solid foundation of the family and the region; it will emphasize the biological and social needs of the people, and it will treat industrial and financial needs as subordinate ones."

Equipment for Buildings

MECHANICAL AND ELECTRICAL EQUIPMENT FOR BUILDINGS—Second Edition, by Charles Merrick Gay and Charles De Van Fawcett. 453 pp. John Wiley & Sons, New York 16, $5.

In the revised edition of this book, whose purpose is to acquaint architects, building managers and students with the basic theories and applications of building equipment, chapters covering heat and heating, induction motors, insulated conductors, air conditioning, elevators, illumination and acoustics have been rewritten and amplified and data on new types of heating, plumbing and water-supply equipment, escalators and fluorescent lamps have been added.

For Building Code Writers

FIRE PROTECTION THROUGH MODERN BUILDING CODES—B. L. Wood. 124 pp. American Iron and Steel Institute, New York 1, N. Y.

This product of years of study of the many problems involved in the conception and application of building code regulations is intended to assist the nationalization and modernization of fire protection requirements by correlating the pertinent scientific data that have become available recently. Features that have proven difficult and confusing to members of code-writing committees in various cities are discussed and suggested building classification and fire protection regulations are included.

Miscellaneous Notes on Booklets and Reprints

A REPORT ON HOUSING COSTS issued by the National Housing Agency under the title, "Housing Costs—Where the Dollar Goes", (Superintendent of Documents, Washington, D. C., 10c.) draws attention to the urgent need for greater efficiency in house building. Costs have not been reduced to any appreciable extent in the past 20 years, the report states, due to technological backwardness, high building materials prices, rising wages and restrictive practices.

CIVIC DEVELOPMENTS IN MEMPHIS from 1940 to '44, are attractively presented with photographs, text and tabulations in a report just issued. The material was compiled by Louise Gambill, municipal librarian.

A LEAFLET on wood structural design has been issued by the National Lumber Manufacturers Association (Washington 6, D. C.) for use pending a revision of the association's book "Wood Structural Design Data" to conform to the recently issued National Design Specifications for Stress-Grade Lumber and Its Fastenings.

A BIBLIOGRAPHY of articles on prefabricated houses with the title, "Prefabricated Structures: 1940-1944", has been compiled by the Edward S. Evans Transportation Research and the library of the U. S. Department of Agriculture, Washington, D. C. Copies can be obtained from the Edward S. Evans Transportation Research, 435 Woodward Bldg., Washington 5, D. C.

AN ELEMENTARY TREATMENT of the scientific principles that underlie British practice in concrete construction is presented in "The Principles of Concrete Making and Its Reinforcement," Technical Paper No. 3 of the Reinforced Concrete Association, London. This 52 page booklet contains no new facts or theories but is rather in the nature of a notebook, summarizing the research and experimental work on the subject in a form that can be readily assimilated and applied in everyday practice. Price 2s 6d.

"PLANNING FOR POSTWAR MUNICIPAL SERVICES" is the title of a 90-page reprint ($2.00) issued by the International City Managers' Association, 1313 E. 60th St., Chicago 37, to stimulate the thinking of municipal administrators and councils in developing sound policies and plans for improving local facilities and services. The 16 chapters of the report appeared originally in *Public Management*, ending in the April, 1945, issue. Leading authorities in the various municipal fields outline the extent of municipal responsibility, anticipate postwar conditions and needs, indicate services that may be expanded, abandoned, or transferred to other units, suggest the sort of questions and problems that should be answered locally, and outline methods of making plans. A list of selected references is included to serve as a guide to municipal officials who want additional information on how others have handled actual cases.

New Engineering Books

BUILDING CONSTRUCTING ESTIMATING—By George H. Cooper. 282 pp. McGraw-Hill Book Co., New York 18 and London. $3.

BUILDING INSULATION, 2ND EDITION—By Paul D. Close. 328 pp. American Technical Society, Chicago. $3.50.

BUILDING TRADES BLUEPRINT READING—By J. Ralph Dalzell. Part I, Fundamentals, 142 pp. $2. Part II, Specifications, Blueprints, and Examinations, 234 pp. $2. American Technical Society, Chicago 37.

THE BOGEY OF ECONOMIC MATURITY—By George Terborgh. 263 pp. Machinery and Allied Products Institute, Washington, D. C. $3.

STANDARD SPECIFICATIONS, APRIL, 1945—State of California Department of Public Works, Division of Highways, Sacramento, Calif. Limited free distribution.

POSTWAR FISCAL REQUIREMENTS, Federal, State and Local—By Lewis H. Kimmel and Associates. 166 pp. The Brookings Institution, Washington 6, D. C. $2.

A.S.T.M. PROCEEDINGS: 47TH ANNUAL MEETING—1,131 pp. American Society for Testing Materials, Philadelphia 2, Pa.

EXPERIMENTAL STRESS ANALYSIS, Vol. II, No. 2—169 pp. Addison-Wesley Press, Inc., Cambridge 42, Mass. $5.

HANDBOOK OF THE MOSQUITOES OF NORTH AMERICA—Second Edition. By Robert Matheson. 314 pp. Comstock Publishing Co., Ithaca, N. Y. $4.

Reports and Pamphlets

THE WATER TABLE IN THE WESTERN AND CENTRAL PARTS OF LONG ISLAND, NEW YORK—By C. E. Jacob. Department of Conservation, Water Power and Control Commission, Albany, N. Y.

PUBLIC WATER SUPPLIES IN EASTERN TEXAS, Vol. I, Anderson County through Harris County. Vol. II, Harrison County through Wood County. Texas Board of Water Engineers, Austin, Texas.

(Continued on p. 176)

STEADY JOBS *and* EQUIPMENT BUYING

SUSTAINED employment is not an attainable goal unless we can moderate the erratic fluctuations which have characterized the markets for producers' equipment in past periods.

In the 35th editorial of this series, "Sustained Construction Activity", it was pointed out that there is no specific that can cure our economy of its "boom-or-bust" proclivities. Rejecting the notion that the construction industry could be so managed as to stabilize business as a whole, that editorial stressed the important contribution it could make to that end, and suggested several practical expedients through which construction activity might be regularized.

Producers' equipment represents an area of production quite as broad and diverse as construction, though smaller in aggregate value. The classification embraces all types of durable equipment bought and used for profit—locomotives, motor trucks, electric generators, conveyors, machine tools, farm implements, and so on down to surgical instruments and dentists' drills.

Although the output of such equipment averages over a long period only 5 or 6 per cent of the nation's total output, it resembles construction in its extraordinary ups and downs. While its component items differ widely in the amplitude and violence of their fluctuations, the class as a whole is one of the most unstable sectors of the economy, making therefore a quite disproportionate contribution to the cyclical swings of total production and employment. From 1929 to 1932, for example, the decline in the output of producers' equipment (at constant prices) was 65-70 per cent, in contrast to a decline of 25-30 per cent in the national output exclusive of such equipment and construction.

A more recent example of the volatility of demand in this field may be found in the movement of a monthly index of orders for industrial equipment, which rose from 92 in the spring of 1936 to 160 in the spring of 1937, falling thence to 65 in the summer of 1938 and rising again to 142 in the fall of 1939. Such fantastic oscillations present an obvious and inescapable challenge to all concerned with economic stabilization.

Not only are these fluctuations bad for the economy; they represent demonstrably bad buying policy on the part of the purchasers of equipment. Peaks in demand come characteristically just before a business depression (1919, 1929, and 1937, for example) when machinery costs the most to buy and install and when it has the lowest expectancy of continuous use. At exactly the wrong moment everyone wants to buy. In the depression itself, on the other hand, with costs down, and with nowhere for the economy to go but up, equipment is a drug on the market. No one wants it when it is cheap and has the greatest prospect for steady employment. Here is a behavior pattern so profoundly irrational there must be hope for its correction.

There is an inveterate tendency for business management to forecast the future simply by projecting the trends of immediate past. Although it is axiomatic that the chance for an extended period of further prosperity is inversely related to the duration of the prosperity already experienced, this truism is generally ignored. The longer the boom has run, the more certain is business management that it will continue indefinitely. Convinced at last by "actual experience" that prosperity is here to stay, executives give the green light to commitments for expansion and modernization previously deferred in a skeptical attitude of "wait and see". The result, so often repeated in our economic history, is an explosive burst of demand for equipment coincident with, and contributing to, the final spasm of a boom. Witness the phenomenal rise in industrial equipment orders during 1928 and the spring of 1929.

The same prophetic illusion works in reverse during a depression. Recent experience is projected into the future. Although the mathematical probability of an imminent and prolonged period of prosperity increases directly with the duration of a depression, it finds little reflection in business decisions. Timidity and caution are the order of the day.

Compounding the errors caused by faulty perspective, are a number of influences which make it extremely difficult for individual enterprises to follow a policy geared to sensible long-term considerations. In a boom, particularly in its climactic phase, most producers find their order books crowded beyond the potential of their current capacities and are faced with the alternatives of expanding or losing trade to competitors. In depression the situation is reversed, and producers with unused facilities find it difficult to justify increases in their capital charges.

An even more controlling factor in many cases is the availability of funds. This is especially important

for small concerns. Typically such firms enjoy but limited credit, and with no ready access to the securities markets, their capital expenditures depend primarily on earnings. When they are making money, they can afford to buy equipment; when they are losing, they largely disappear from the equipment market. Even great enterprises, though less dependent on earnings as a source of capital financing, are profoundly influenced by the volume of internal funds available for the purpose, a volume as a rule far greater in prosperity than in depression. Moreover, it is usually easier in good times to obtain outside funds through the sale of stock or by borrowing, since in bad times bankers, underwriters, and investors are susceptible to the same timidity and caution that afflict business management generally.

We are dealing here with a combination of psychological, physical, and financial forces which conspire to aggravate the instability of demand for capital equipment. What can be done to reduce this instability and thus to bring equipment purchasing into a more sensible and constructive pattern?

There is no panacea, no royal road to the solution. The problem has been with us since the beginning of the industrial economy. It is complex and difficult. It is not, however, wholly intractable. We may reasonably hope that industry will, through intelligent effort, make substantial progress toward a satisfactory solution. The industrial equipment field is one in which government, except for war periods, has exerted little direct control. The best insurance against the institution of government measures is to so conduct activities in the equipment field that no justification for government interposition can be made.

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1. The first and most important step is for industry itself to reconsider its heretofore haphazard and opportunistic policy in the purchase of equipment, substituting so far as possible a regularized, long-range programming of expenditure that will resist both the excited long-buying of booms and the equally disturbing underbuying of depressions. Such long-range programming is particularly appropriate and advantageous for large enterprises in established industries such as railroads, electric power, steel, automobiles, and the like, but it makes sense much more generally.

Once executives come to realize that a reasonably stable equipment program contributes not only to the welfare of the economy but also to the lowering of their long-run equipment costs, the opportunity to combine a public service with private advantage should induce them to recast their policies accordingly.

There is an even more compelling reason for purchasers of industrial equipment to do everything possible to regularize their demands. Some concerns unquestionably will find themselves in a postwar position where speedy delivery of needed equipment, even though it involves the payment of premium prices, will seem to be justified. But there is no system of accounting that can show it to be a profitable transaction to promote an equipment industry boom that runs a brief course only to collapse when the backlog of deferred maintenance and development has been satisfied. That, historically, has been the trigger which trips the door to the depression phase of the business cycle. No immediate advantage can compensate for the contagious paralysis that infects all business enterprise when major layoffs occur in any major segment. No precautionary measures, self-imposed by business, can be regarded as unduly severe if they can prevent this devastating blight.

2. Financial agencies can and should play a responsible role in regularizing equipment demand. Funds for the purchase of producers' equipment should be offered boldly and at low interest during depression periods, and should progressively tighten as a boom market bids up the price of purchase and installation. Banks and financial houses have excellent facilities for gathering and interpreting market and general economic information. It is good business for them, and for the national economy, to exercise their accepted discretions in a manner that will help to promote economic stability.

3. There now is almost universal recognition of the need for a thorough-going revision of our corporate tax structure to the end that effective incentives may be offered for private capital investment. The possibility of including provisions which would offer special tax concessions to equipment investments made in depression periods is worthy of intensive exploration.

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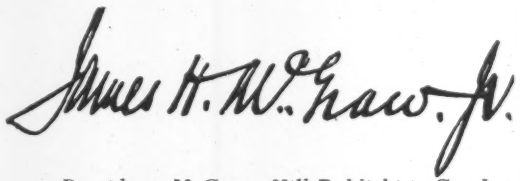
The fundamental problem here is educational. If all business enterprises in a position to do so were to regularize their equipment expenditures, it would have a tremendously beneficial effect. True, it would accomplish no miracles. For many concerns it is not feasible to schedule equipment buying over a long period. Even those who do schedule it are likely in practice to attain only a relative stability. It must be acknowledged, moreover, that few programs could withstand indefinitely a very deep and prolonged depression such as we had in the thirties. Nevertheless the adoption of stabilization policies where feasible would make a signal contribution both to the restraint of booms and to the mitigation of depressions. Here is something industry can do for itself.

It is easy to disparage such remedies for economic instability as are here proposed on the ground that they are partial only. However, joined with others also partial, they can achieve in combination a solid progress toward the goal of sustained high level employment—progress that is unattainable through economic cure-alls. The road suggested is a slow road, and difficult, but it leads upward.



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CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

HIGHWAY IMPROVEMENTS NEW YORK

OWNER: New York Dept. of Public Works, Albany.

PROJECT: Resurfacing portion of highway (28.61 miles) from Pennsylvania State Line through Westfield, Brocton, Fredonia and Silver Creek in Chautauqua County, N. Y., with bituminous macadam on concrete base (bituminous macadam mixing method optional). Thickness of bituminous macadam top course 2-in. and variable. Work also involves concrete base widening.

CONDITIONS: Contractor to furnish all materials and complete work by October 1, 1945. Rail and highway transportation facilities available. Wage rates specified are: skilled labor, 85c. to $1.625 per hour; semi-skilled, 85c. to $1.625; and common labor, 85c. to $1.25. On this project, however, the contractor is seeking permission to pay higher rates than those stipulated because of inability to obtain men at the stated rates.

BIDS: Thirteen bids were received April 11, 1945 ranging from the contract low of $583,323 to $714,472. Engineer's estimate $763,977. Awarded April 16, 1945.

LIST OF BIDDERS:

1. Warren Bros. Roads Co., Cambridge, Mass. (contract) $583,323
2. D. W. Winkelman Co., Inc., Syracuse, N. Y. 589,296
3. Louis Mayersohn, Albany, N. Y. 607,304
4. Bero Engr. & Constr. Corp., Buffalo, N. Y. 620,662
5. Bison Contracting Corp., Buffalo, N. Y. 622,936
6. Depew Paving Co., Depew, N. Y. 623,604
7. Fago Construction Co., Buffalo, N. Y. 624,948
8. Allegheny Asphalt & Paving Co., Pittsburgh, Pa. 649,487
9. Baldwin Bros. Paving Co., Erie, Pa. 652,377
10. Mohawk Paving Co., Inc., Buffalo, N. Y. 662,521
11. John B. Schultz Cont'g. Co., Inc., Buffalo, N. Y. 667,043
12. Lane Construction Co., Meriden, Conn. 704,498
13. Del Balso & Spragus, Inc., New York, N. Y. 714,472

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Unclassified excavation	17,300 c. y.	$0.30	$0.40	$0.50
2. Borrow excavation	19,400 c. y.	.75	.65	1.00
3. Trim shoulders	144,495 l. f.	.055	.05	.05
4. Preparaing fine grade	65,245 s. y.	.20	.20	.20
5. Portland cement	20,445 bbl.	2.15	2.50	2.80
6. Concrete found'n. for pavmt.	14,480 c. y.	7.70	7.00	7.70
7. Top course, bitum. mat'l., mixing method optional	53,550 ton	6.57	6.50	6.60
8. Bitum. macadam asph. paving	14,200 gal.	.13	.11	.12
9. Maintain traffic for bit. macadam.	20,878 l. f.	.05	.10	.10
10. Maintain traffic for bit. macadam.	130,275 l. f.	.10	.20	.10
11. Protection of traffic	Lump Sum	10,500 00	10,500 00	10,500 00
12. Clean existing pavement	24.78 mi.	55.00	50.00	50.00
13. Bottom course, bitum. macadam, penetr. method	1,200 c. y.	6.00	6.00	6.60
14. Remove and store old street car rails	Lump Sum	330.00	300.00	330.00

HIGHWAY IMPROVEMENTS AND BRIDGES, WASHINGTON

OWNER: Washington State Highway Dept., Olympia.

PROJECT: Clearing, grading, surfacing and construction of six bridges on the Austin Pass Branch of Primary State Highway No. 1, from Glacier to Mt. Baker in Whatcom County, Wash.

CONDITIONS: Contractor to furnish all materials and complete work in 180 calendar days. Highway transportation available to site of work. Wage rates are: skilled labor $1.48 to $1.745 per hour; semi-skilled, $1.15 to $1.48; and common labor, $1.15.

BIDS: Ten bids were received April 3, 1945, ranging from contract low of $67,613 to $107,132.

PARTIAL LIST OF BIDDERS:

1. Axel Osberg, Seattle, Wash. (contract) $67,613
2. Scheumann & Johnson, Seattle, Wash. 69,748
3. M. P. Butler, Seattle, Wash. 71,299

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Clearing and grubbing	Lump sum	$1,500 00	$800.00	$2,000 00
2. Unclassified excavation (incl. haul)	380 c. y.	1.75	2.00	1.50
3. Common excavation (incl. haul)	1,390 c. y.	1.00	2.00	1.00
4. Solid rock excav. (incl. haul)	520 c. y.	4.00	2.00	2.50
5. Finish roadway	8.6 sta.	20.00	50.00	20.00
6. Sel. roadway borrow, incl. haul	520 c. y.	2.50	4.00	3.00
7. Crushed stone surf. top course in place on rdwy. from stockpiles	250 c. y.	3.50	5.00	2.50
8. Loose riprap, Class A, in place	20 c. y.	5.00	5.00	4.00
9. Construct and remove 5 detours	Lump sum	5,000 00	1,000.00	6,000.00
10. Structural excavation	1,094 c. y.	3.50	5.00	10.00
11. Concrete, Class A, in place	445 c. y.	45.00	45.00	38.70
12. Concrete, Class B, in place	378 c. y.	40.00	45.00	38.70
13. Steel reinforcing bars, in place	138,000 lb.	.06	.07	.06
14. Structural steel, in place	5,000 lb.	.07	.30	.15
15. Rein. conc. bridge railing, in place.	658 l. f.	6.50	6.00	4.00
16. Bridge drains	3 ea.	50.00	40.00	50.00
17. Remove six existing structures	Lump sum	2,500.00	1,775.00	3,000.00

WATER SUPPLY LINE, BETHLEHEM, PA.

OWNER: City of Bethlehem, Pa., Dept. of Engineering.

PROJECT: Construction of 34-in. reinforced concrete water supply line from East Third St. to Dewberry Ave. and Main St. Involves furnishing and laying of 34-in. and 20-in. concrete pressure pipe, 30-in. cement-lined cast iron pipe, 12- and 20-in. bell and spigot cast iron pipe, valve chambers and valve box, 84-in. liner plate tunnel 160 ft. long, and necessary rock and earth excavation. Also concrete for concrete-lined tunnel.

CONDITIONS: Contractor to furnish all materials. Wage rates to be paid are those prevailing in area.

BIDS: Five bids were received April 10, 1945, ranging from the contract low of $474,123 to $598,193.

PARTIAL LIST OF BIDDERS:

1. Francis A. Canuso & Son, Philadelphia, Pa. (contract) $474,123
2. James A. Driscoll Co., Philadelphia, Pa. 541,123
3. Kaufman Construction Co., Philadelphia, Pa. 570,335

Item	Quan.	Unit Prices (1)	(2)	(3)
1. 34-in. concrete pressure pipe	10,118 l. f.	$21.00	$23.25	$20.00
2. 20-in. concrete pressure pipe	1,805 l. f.	11.00	17.80	15.60
3. 30-in. cast iron pipe, Class F, cement-lined	2,500 l. f.	49 00	46 30	60 00
4. 20-in. b. & s. cast iron pipe, Cl. D.	140 l. f.	26 00	15.00	60 00
5. 12-in. b. & s. cast iron pipe, Cl. D.	900 l. f.	7.00	6 00	10.00
6. As above, Class B	1,000 l. f.	6.50	5 00	8.00
7. Valve chamber, Type A, complete.	1 ea.	12,500 00	12,000 00	13,000 00
8. Valve chamber, Type B-30, compl.	1 ea.	14,000 00	12,000 00	16,000 00
9. Valve chamber, Type E, complete.	4 ea.	5,000 00	4,750 00	5,000 00
10. Valve chamber, Type F-1, compl.	1 ea.	650 00	300 00	400 00
11. Valve chamber, Type F-2, compl.	2 ea.	550.00	300.00	550 00
12. Valve box with 10-in. blow-off tee and 10-in. flanged gate valve	1 ea.	280.00	600.00	250 00
13. Conc. for conc. lined tunnel (1:2:4 mix)	630 c. y.	36.00	40.00	55 00
14. Rock excavation in tunnel	1,200 c. y.	15.00	50 00	45 00
15. Rock excavation in trenches	500 c. y.	20.00	6.00	15 00
16. 84-in. liner plate tunnel	160 l. f.	19.00	75.00	110 00
17. Extra earth excavation	200 c. y.	3 00	4 00	5 00

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SPRAY IT ON

No paper — No burlap

Produces better concrete

One-Man operated Tru-Cure Multiple-Nozzle Applicator. (Patented)

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Continuous Operation — Right Behind the Finisher

Since extended research has proved the astounding effectiveness for moisture-retention of Truscon Tru-cure type of curing film—it now becomes a matter of applying that curing film over large concrete areas in such a manner that there will be no breaks or leaks in the film's continuity.

For that purpose, the one-man-operated, TRU-CURE Multiple-Nozzle Applicator shown above was designed and built by Truscon concrete engineers.

Scientific tests have proved this to be the fast, time-saving and dependable method of applying the transparent, water-retaining concrete curing compound to a uniform thickness. It lays a protective film over all the concrete surface—no "skips" no thin spots.

This convenient, efficient, one-man applicator is one of Truscon's contributions to "better concrete." Properly cured concrete is better concrete.

These TRU-CURE Machines have helped make possible the nation's tremendous airport and military roadway expansion. Machines are available, either through the sales agencies of the Truscon Laboratories, or are built by machinery dealers for road contractors. Blue prints and specifications may be had, no charge, by communicating with address below, or any Truscon Laboratories' office.

TRUSCON TRU-CURE

Used on millions of square feet of concrete—Truscon Tru-Cure met the war emergency for more roads, and better roads, rapidly constructed. It has proved to be the most successful method of curing large concrete areas—factory floors, roof slabs, highways, airport runways.

Tru-Cure curing follows right behind the finisher—no time lost—makes possible water retention during that early critical period where lack of curing causes hair checks and shrinkage cracks in concrete.

Equivalent to 14-day water curing—no burlap—no paper—no worry about keeping concrete wet—no cleaning up afterwards.

Truscon Tru-Cure is a clear liquid—requires no removal, as film weathers off in a short time. Approved by United States Army Engineers and numerous State Highway Departments.

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MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

CONSTRUCTION MATERIAL prices and labor rates reported to *Engineering News-Record* for July show only minor changes from the preceding month. Portland cement is 8c. per barrel lower in St. Louis, and ready-mixed concrete is down 25c. per cubic yard in Los Angeles.

Iron and steel products are unchanged from a month ago except for the 50c increase in expanded metal lath prices in Baltimore. Pipe prices, except for a 5c. rise in 24-in. concrete pipe, remain at June levels. Lumber prices are up in Minneapolis on both pine and fir on 1-in. sizes, and higher prices are also reported in Montreal on 1-and 2-in. boards.

Common brick prices advanced in Baltimore and Pittsburgh, and in New York the price situation is confused and no quotation is available for July.

Bricklayers' rate in Denver rose 15c. to $1.80 per hour and the plasterers' rate formerly $1.50 to $1.65 per hour, is now $1.65. In Chicago, the structural iron workers' rate climbed from $1.75 to $1.85, and in Kansas City, the plasterers' rate rose from $1.70 to $1.75 per hour. Common labor rates remain the same as a month ago.

CEMENT, AGGREGATE, READY-MIXED CONCRETE—F.O.B. CITY

	PORTLAND CEMENT (Per bbl., C/L lots, incl. 40c. per bbl. for bags, cash dis. not deducted)			SAND AND GRAVEL (Per ton, carload lots)			CRUSHED STONE (Per ton, carload lots)		CRUSHED SLAG (Per ton, carload lots, f.o.b. plant)		CONCRETE BLOCK (8x8x16-in.; truckload del.; per block)		READY MIXED CONCRETE (1:2:4, over 5 sk. per c.y., del)
	Cloth *a*	Paper	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand-grav.	Lt.wgt. Agg.	50 c.y., del
Atlanta	$2.77	$2.52	$2.47	$1.79	$1.89	$1.99	$1.79	$1.89	$1.59	$1.69	$0.17	....	$8.30
Baltimore	2.62	2.37	2.12	1.80‡	1.80‡	1.30‡	1.80‡	1.80‡	1.75‡	1.75‡	.125	$0.125*w*	7.45
Birmingham	2.50	2.25	2.10	1.75	1.75	1.50	.85	1.00	.90	1.15	.1425	....	5.80
Boston	2.97*b*	2.72*b*	2.52*b*	1.50‡	1.50‡	1.05‡	1.25‡	1.35‡	....	....	.13	.155*w*	7.55*m*
Chicago	2.90	2.65	2.50	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	1.75‡	1.75‡	.18	.18*x*	....
Cincinnati	2.41	2.16	1.96	1.20	1.20	1.10	1.80	1.80	....	....	.12	.15*w*	6.70
Cleveland	2.49	2.24	....	1.75*i*	1.75*i*	1.55*i*	1.80*i*	1.80*i*	1.73‡*i*	1.73‡*i*	.14	.14	7.45
Dallas	2.51	2.26	2.06	1.50*p*	1.70*p*	1.10*p*	1.69*p*	1.79*p*	....	....	.15	....	7.15
Denver	3.08	2.88	2.32	1.20	1.30	1.25	1.65	1.75	1.00	1.00	.15	....	7.25
Detroit	2.49	2.24	2.09	1.50	1.50	1.30	2.25	2.25	2.00‡	2.00‡	.13	.14*w*	7.15
Kansas City	2.58	2.33	2.18	1.85	2.30	1.00	1.91	1.91	....	....	.125	.125*wy*	7.50*n*
Los Angeles	3.20*s*	2.60*s*	....	1.30	1.30	1.15	1.30*f*	1.30*f*	....	....	.045*bb*	.10*aa*	7.25
Minneapolis	3.07	2.82	....	1.00*h*	1.00*h*	.25*h*	1.00*h*	1.00*h*	....	....	.12	.16	7.55*j*
Montreal	....	1.95*rs*	1.79*rs*	1.65‡*s*	1.65‡*s*	1.50*t*	.80*ct*	.90*ct*	....	....	.14*t*	.14*wt*	7.85*u*
New Orleans	2.41	2.16	1.92	1.67	1.65	1.22	....	....	.90	1.15	.19	....	9.25
New York	2.85‡	2.60‡	....	1.60*de*	1.60*de*	.90*de*	1.70*de*	1.80*de*	....	....	.16	.14*wcc*	7.50*k*
Philadelphia	2.73	2.48	2.28	1.55‡	1.65‡	1.20‡	1.90	1.95	1.10	1.10	.155	.155*w*	8.45
Pittsburgh	2.70	2.45	2.25	1.65‡	1.65‡	1.85‡	2.25‡	2.25‡	1.50	1.50	.17	.17*z*	8.40
St. Louis	3.00	2.72	....	1.75‡	1.40‡	1.25/1.40‡	1.25*h*	1.25*h*	.90*y*	1.10*y*	.145	.13*w*	8.60
San Francisco	2.21	2.01	1.71	1.36	1.36	1.36	1.46	1.46	....	....	....	.21*y*	7.55
Seattle	....*u*	3.00*o*	....	2.35*d*‡	2.35*d*‡	2.35*d*‡	2.00*o*	2.00*o*	....	....	.16	.16*y*	7.25

‡ Delivered. *a* 10c. allowed for each returnable bag. *b* 10c. per bbl. off for cash. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount of 2 percent for each in 10 days. *l* Up to 200 cu. yd. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 10c. per ton off, cash 15 days. *r* 10c. per bbl. off, cash 20 days. *s* 8% sales tax included. *t* 8% sales tax not included. *u* Withdrawn. *v* 20c. per bbl. discount; 20c. allowed for returnable cloth bag. *w* Cinder. *x* Waylite. *y* Haydite. *z* Celocrete. *aa* Pumice. *bb* 4 x 8 x 12 in. *cc* Also 8 x 18 x 18 in.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

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Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind	$1.90	$1.85	Ironton, Ohio	$1.70	$1.65	Richard City, Tenn	$1.80	$1.75
Dallas, Tex	....	....	Limedale, Ind	....	....	Steelton, Minn	2.00	1.95
Hannibal, Mo	1.90	1.85	Norfolk, Va	....	....	Universal, Pa	1.75	1.70
Hudson, N. Y	....	....	Northampton, Pa	1.75	1.70	Waco, Tex. (Plus 9c. tax in Tex.)	1.75	1.70
Independence, Kans	1.70	1.65	North Birmingham, Ala	....	....	Montreal City (8% sales tax incl.) Discount 10c. per bbl. 20 days	1.68	1.67

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS—F.O.B. CITY

	PAVING BRICK AND BLOCK			PAVING ASPHALT (Per ton, less than 80 penetration)		ASPHALT BINDERS—FLUXES (Per gal., 80–300 penetration)		CUTBACK ASPHALT (Per ton)		ROAD OIL (Per gal.)	ASPHALT EMULSION (Quick-breaking) (Per gal.)	
	Granite per M lots of 50,000 4x4x8 in.	Brick per M 3x4x8¼ in. carload lots	Wood per sq. 6d. 3¼ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	$39.35	$2.25	$18.53*e*	.....†	$0.0740*e*	.....†	$0.0806*he*	.....†	$0.0781*e*	$0.0806	.....†
Baltimore	150.00‡	49.00	85.00*m*	15.00*r*	21.00*r*	.06*r*	.09*r*	13.00*r*	23.00*r*	.06*r*	.07*r*	.14*r*
Birmingham	150.00	32.00*j*	.....	17.95	.....†	.0747	.....†	.0834*h*	.....†	.065	.095	.....†
Boston	85.00	59.00	3.75	15.00	24.00	.0625	.115	17.00	30.00	.0625	.0825	.145
Chicago	150.00	55.00	2.50/2.80*d*	14.00	22.50	13.00*g*	21.50*g*	.0575*h*	.15*h*	.05*n*	.09/.10*n*	.13/.15*n*
Cincinnati	120.00	53.75	.....	17.00	.....	.085	.....	12.25	.....	.07	.085	.....
Cleveland	120.00	37.25	3.50*l*	17.00	19.00	.085	.095	.10*h*	.11	.08	.10	.....
Dallas	.....	36.00	.....	13.65	20.30	.06	.11	16.00	24.80	.06	.05/.07	.07/.09
Denver	.....	16.11	.....	11.00	.....	10.00	.....	.045*h*	.....	.....	.....	.....
Detroit	.....	37.00	.....	18.06*f*	25.60*f*	.0734	.128	.0718*h*	.119*h*	.067	.0775	.1149
Kansas City	.....	30.00	.....	18.50	23.50	.077	.1075	.077*h*	.107*h*	.057	.11	.15
Los Angeles	.....	50.00	.....	9.00*b*	23.00	9.50*bg*	24.00*bg*	9.50*b*	.....	.025	.072	.15
Minneapolis	.....	.....	2.30*d*	.....	27.70	.....	.126	.....	32.64	.....	.....	.....
Montreal	92.40	.....	.....	16.60*k*	24.25*k*	.116*k*	.1485*k*	.115*hk*	.135*hk*	.08*k*	.135*k*	.188*k*
New Orleans	.....	.....	.....	13.50*a*	20.00*a*	.057	.088	.06*h*	.095*h*	.....	.080	.....
New York	.....	65.00	.....	17.40	24.20*p*	14.00	.....	.0725*h*	.1325*hp*	.....	.0725*p*	.119*p*
Philadelphia	140.00	58.00	4.06	15.00*r*	.....	14.00/15.00	.....	.0625*h*	.....	.....	14.00*gr*	.....
Pittsburgh	135.00	39.75	.....	18.00	23.00	.09	.16	20.00	36.00	.07	.06	.11
St. Louis	.....	39.00	.....	16.00	22.00*e*	15.00*g*	21.00*g*	.0575*h*	.1212*h*	.648	.06	.11
San Francisco	.....	45.00	.....	10.90	21.15	10.90*g*	18.00*gr*	12.90	17.50*r*	9.50*gr*	.0525	.1125
Seattle	.....	.....	.....	10.90*i*	21.90*i*	.....	20.40*gi*	11.40*i*	.....	.....	.0525*i*	.0625

‡ Delivered. *a* F.o.b. Baton Rouge. *b* Delivered to purchaser's warehouse. *c* 3½x4x8½ in. *d* 2½ in. 12-lb. treatment. *e* Local reduction due to 20% reduction intra-state class freight rates, only Georgia affected. *f* Mexican. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* 3x3½x8½ in. *k* Tax included. *l* F.o.b. Toledo. *m* Per thousand. † Available on priority only and quoted specially. *p* No steel drum shipments except to armed forces. *r* February 1943 prices, none later available.

Shocker story—with a new kind of hero

THE rocky road to destruction—that's what many big, costly tires travel on the kind of tire-shocking work you see above. For there are sledgehammer blows to the tire whenever it hits a rock, rut, or stump—impacts under ton-loads that cause bruises, ply separation, blow-outs, and even a ruined tire. Lost time and repairs from such accidents are costly; a ruined tire means an *extra* loss, perhaps amounting to several hundred dollars.

To protect users of off-the-road tires against such losses, B.F.Goodrich engineers developed a new tire construction principle—the shock-shield. This *shield* gives greater protection against bruises and blow-outs. It is built in under the tread—is a set of four breakers... layers of rubber-coated rayon cord fabric ... insulated with thick cushions of special shock-resisting rubber.

When the tire is "hit", the breaker-cords stretch in unison—do *not* criss-cross—and return to their original position. The blow is evenly distributed, *not* concentrated, and is absorbed by the rubber cushions. Thus, the cord body receives only a greatly reduced, eased-off shock.

Records show exceptional results

Users of B. F. Goodrich off-the-road tires report greatly improved tire service records—fewer bruises, twice-as-long wear, reduced repair bills. One operator reports 17,226 miles from BFG tires compared with 12,501 for the best of three ordinary tires used; another, 17,599 miles compared with 6,476 for the best ordinary tire; and a strip mine operator's records show an average of over 4,000 hours of service for BFG Universal tires compared to 1,600 hours from another make.

Savings for you

Your off-the-road equipment *can* serve you better, at less cost, if it has the exclusive working advantages of B. F. Goodrich tires. You can prove this in your own comparison tests of BFG tires alongside other makes. We urge you to try it.

To get best delivery of BFG off-the-road tires, place tentative orders early; supplies are limited. See the local B. F. Goodrich dealer or write us direct. *The B.F.Goodrich Co., Akron, Ohio.*

Truck Tires BY

B.F. Goodrich

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF. BARS ¾-in. billet *b*	RIVETS ½-in. structural	WIRE NAILS Base *d*	SHEET PILING Base	STEEL RAILS Per Gross Ton Standard	Light	Re-rolled	TRACK SUPPLIES Angle Bars	Std. Spikes *e*	Tie Plates *e*	Track Bolts
Birmingham	$2.10	$2.15	$3.75	$2.90	.....	$43.00	$45.00	$43.00*	$2.70	$3.25	$2.30	$3.75
Chicago	2.10	2.15	3.75	2.90	$2.40	43.00	45.00	45.00*	2.70	3.25	2.30	3.75
Pittsburgh	2.10	2.15	3.75	2.90	2.40	43.00	45.00	43.00*	2.70	3.25	2.30	3.75
Buffalo	2.10	2.15	.....	.....	2.40	.....	.....	.....	....	....	2.30	....
Cleveland	2.10	2.15	3.75	2.90	.....	.....	.....	.....	....	....	....	....
Youngstown	....	2.15	.....	.....	.....	.....	.....	.....	....	3.25	....	....
Detroit	....	2.27‡	.....	.....	.....	.....	.....	.....	....	....	....	....
Gulf ports	2.47*a*	2.52*a*	.....	.....	2.85*a*	.....	.....	.....	....	....	....	....
Pacific ports	2.75*a*	2.80*a*	.....	3.40	2.95*a*	.....	.....	.....	....	....	....	....

‡ Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per cl basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates alone, Steelton, Pa., on • Per net ton.

IRON AND STEEL PRODUCTS—F.O.B. WAREHOUSE, PER 100 LBS., BASE PRICE

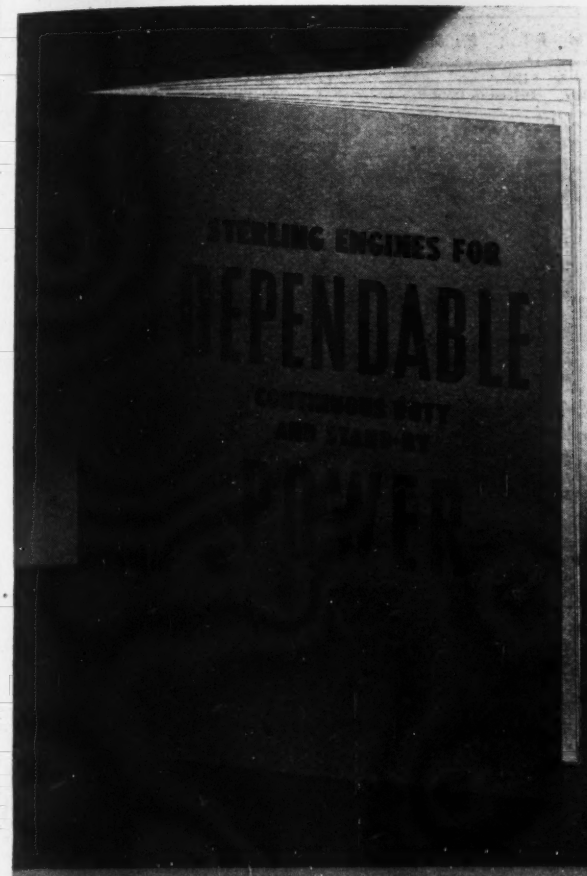
	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS* Per 100 lb., ¾ in., base price 15 tons or over *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH Per 100 sq. yd., carload lots Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq. ft., carload lots 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in. No. 6 & 6 wires *k* Per 100 s. f.	SHEET PILING Per 100 lb. base price
Atlanta	$2.34	$2.40	$2.40	$.02‡	$.10	$21.06	$23.00	$1.82	$1.35	$1.91	$3.04
Baltimore	3.70	2.90	2.75	....	.10	23.00	25.00	1.70	1.27	1.79	3.00
Birmingham	2.10*a*	2.15	2.15	.02‡	.10	19.00	21.00	1.80	1.34	1.89	....
Boston	3.912	3.994	....	$20 C.L.	.10	18.50	29.50	1.76	1.31	1.84	2.77
Chicago	2.10*a*	2.15*a*	2.15*a*	.03	.05	21.50	23.50	1.67	1.25	1.75	2.40
Cincinnati	3.68	2.53*ed*	2.53*ed*	....	.05	19.50	21.50	1.66	1.25	1.74	....
Cleveland	3.588*k*	3.10*k*	3.10*k*	.02‡	.10	19.50	21.50	1.66	1.25	1.74	....
Dallas	4.25	3.17	3.17	....	....	25.50	27.50	1.93	1.42	2.03	....
Denver	4.57	3.33*k*	....	....	....	26.50	26.50	1.97	1.45	2.07	....
Detroit	3.661‡	2.50‡	2.50‡	....	.10	30.00	30.00	1.68	1.26	1.76	2.66
Kansas City	4.19	2.61*ed*	2.61*ed*	.0	.05	24.50	26.50	1.78	1.33	1.87	2.874
Los Angeles	3.65*f*	2.575	2.425	.02‡	.05	23.00	27.50	1.93	1.42	2.03	3.65
Minneapolis	3.81‡	2.73	2.73	.0	.10	25.00	27.00	1.80	1.34	1.89	2.73*d*
Montreal	3.95*i*	2.90*i*	2.80*i*	....	....	31.00*hi*	46.00*hi*	2.76	3.44*i*	.282*im*	....
New Orleans	4.229‡*k*	2.52	2.52	.05	.10	19.00	21.00	1.82	1.35	1.91	2.875
New York	3.75	2.76*e*	2.76*e*	....	.15	17.50	19.50	1.76	1.32	1.81	2.74
Philadelphia	3.666	3.668	....	....	....	20.50	22.50	1.71	1.28	1.79	2.72
Pittsburgh	2.10*a*	2.15*a*	2.15*a*	.02‡	.10	23.00	26.50	1.59	1.20	1.67	2.40
St. Louis	3.697	2.74	2.74	.0	.05	28.00	34.00	1.69	1.27	1.78	2.70
San Francisco	4.35	2.825	2.675	.02‡	.10	21.00	24.50	1.93	1.42	2.03	3.70
Seattle	2.75*e*	2.80*e*	....	....	....	34.50	38.50	1.93	1.42	2.03	2.95*e*

‡ Delivered. *a* Mill prices. *b* 5–15 tons, add 15c. 1–5 tons, add 25c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. dock. *f* Includes delivery in free delivery zone. *g* Less than 1 ton, add 25c.; 1 to 5 tons, add 10c. * High scrap steel prices cut former 15c. differences between new billet and rail steel in many mills. *h* List price. *i* Plus Dominion and Province sales tax. *k* Quotation on changed basis; no actual price change. *m* Per sq. yd.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in.*a*	VITRIFIED SEWER PIPE Per foot, std. 8 in., s.s.	Delivered std. 12 in., s.s.	ASTM 24 in.	C13–35 36 in.	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM C 14–35 12 in.	24 in.	WROUGHT STEEL PIPE Full standard weight, *h* 1 to 3 in., Butt Weld Black %	Galv. %	3½ to 6 in.; Lap Weld Black %	Galv. %
Atlanta	$50.66	$0.31*b*	$0.558*bc*	$3.082*c*	$5.70*c*	$110.00	$140.00	$0.45	$1.70	48.2	54.2	59.7	51.2
Baltimore	54.00	.35	.60	2.70	7.25	160.00	200.00	.60	1.90	65.5	57.5	63.0	54.5
Birmingham	46.00	.275	.495	1.95	5.50	100.00	220.00	.50	1.70	62.2	54.2	59.7	51.2
Boston	56.40	.371*r*	.7155*r*	2.79*r*	7.6875*r*	170.00‡*r*	265.00‡*r*	.60	1.95	....	....	....	....
Chicago	55.33	.35	.675	2.70	7.00	100.00‡	150.00‡	.45	1.85	66.0	55.0	64.5	53.0
Cincinnati	54.27	.231	.4455	1.80	5.125	105.00‡*s*	170.00‡*s*	.75*t*	1.75*t*	57.1	43.4	54.0	39.6
Cleveland	55.75	.245*r*	.4725*r*	2.115*r*	5.535*r*	90.60	139.40	.36	1.38	68.5	57.5	66.0	54.5
Dallas	57.43	.31	.58	2.25	5.00	90.00	110.00	.46	1.57	....	....	....	....
Denver	62.56	.29†	.52†	2.16†	3.00*u*	125.00	200.00	1.00†	2.00†	58.4	50.4	55.7	47.2
Detroit	55.75	.385	.7425	2.925	7.75	170.00‡*u*	263.00‡*u*	.36	1.75	57.6	44.0	54.5	40.2
Kansas City	56.73	.35	.59	2.20	6.20	140.00	260.00	.45	1.60	35.6	46.1	46.2	59.4
Los Angeles	69.40	.325†	.585†	2.70†	6.75†	130.50	217.50	1.00	2.00	61.1	50.1	58.6	47.1
Minneapolis	60.10	.305†	.549†	2.196†	6.25†	.....	.....	.90	2.10	64.2	53.2	60.7	49.2
Montreal	67.00	.85*o*	1.50*o*	5.25*p*	8.50*ep*	45.00*m*	64.00*m*	.48*m*†	1.92*m*†	....	....	....	....
New Orleans	52.78	.37*r*	.78	1.69	.....	150.00	220.00	.45	1.65	62.4	54.4	58.8	50.3
New York	53.40	.336	.648	2.835	6.97	.....	.....	.60	1.40	64.9	53.9	62.4	50.9
Philadelphia	52.00	.35	.675	2.75	7.50	165.00	225.00	.45	1.75	56.6	42.8	53.6	39.1
Pittsburgh	57.00	.266†	.513†	2.295†	5.945	97.80	154.20	.85*g*	2.00*g*	68.5*i*	57.5*i*	66.0*i*	54.5*i*
St. Louis	55.62	.31	.504	2.016	4.50	90.80	220.00	1.00*j*	2.15*k*	56.4	42.6	52.5	38.4
San Francisco	69.40	.3625*t*	.6525*t*	2.61	6.52	115.00	192.50	.58	2.34	45.0	31.0	41.0	26.0
Seattle	71.20	.40	.72	2.88	7.20	115.20	.....	.51*f*	1.44*f*	....	....	....	....

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier, C.L. lots, 200 tons and over Burlington, N. J. (base) $50.00 Based on existing freight rates; subject to rate change. Gas pipe and class A, $3 per ton additional, 4 in., $3 per ton additional, 30 in. and larger usually $2 per ton less. *b* Double strength. *c* List to dealer. *d* List. *e* 30-inch. *f* Less 5% for cash. *g* Culvert pipe. *h* Discounts from standard list consumers carload prices, except Pittsburgh prices are f.o.b. mill. Base price $200 per net ton. List prices per ft.; ½ in., 8½c.; ¾ in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92; 3 per cent tax on transportation costs not included. *i* Applies also at Lorain, Ohio, mills. Chicago delivered base is 2½ points less on butt, 1½ on lap. Freight is figured from Pittsburgh, Lorain, O., Chicago Dist. Billing is from point producing lowest price at destination. WROUGHT IRON PIPE: Base price and list prices per ft. same as wrought steel pipe. Discount for Pittsburgh base. Butt-weld—1 in. and 1¼ in. black 34, galv. 16; 1½ in. black 38, galv. 18½; 2 in. black 37½, galv. 18. Lapweld—2½ in. to 3½ in. black 31½, gal. 14½; 4½ in. to 8 in. black, 32½ galv. 17. *j* Reinforced; spec. C 76–37. *k* Reinforced; spec. C 75–37. *l* Plus sales tax. *m* Tax included. *n* 27-in. pipe: *o* Less 50%. *p* Less 53%. *r* Truck delivery. *s* Price quotations on delivered basis since Mar. 1940; current f.o.b. price $84 for 6 in.; $130 for 8 in. *t* Reinforced pipe prices since May, 1937; current plain pipe prices are: 12 in., 36c.; 24 in., $1.50. *u* Scarce: carload quantities not readily available.



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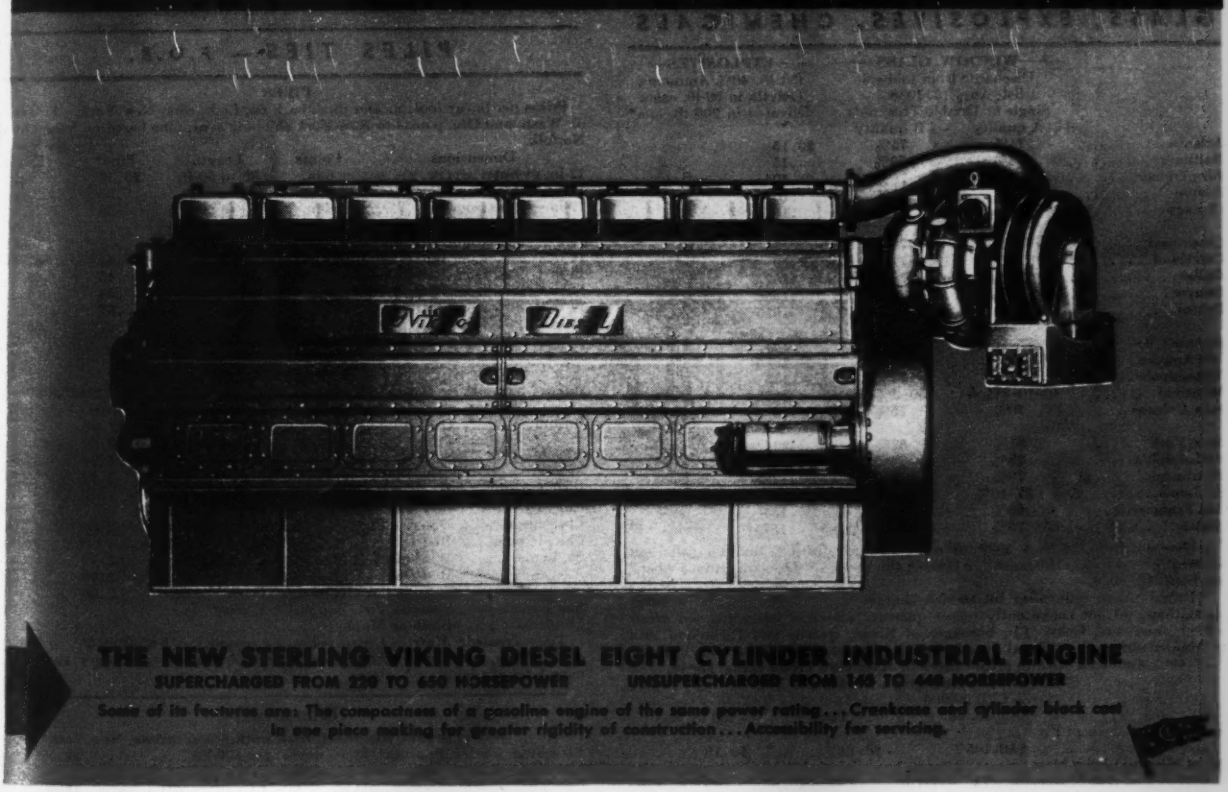
This new booklet describes the outstanding features of the complete line of Sterling continuous duty and stand-by engines—gasoline, gas and diesel—supercharged and unsupercharged—from 75 to 1800 horsepower.

Every engineer and construction executive who is concerned with the problems of power application—in scores of fields—will find therein the latest developments in engine power by Sterling. Write for your copy. No obligation.



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DISTRIBUTORS IN PRINCIPAL CITIES

LUMBER, TIMBER PLYWOOD—PER M FT., B.M., CARLOAD LOTS F.O.B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR— All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face)									LONG LEAF Y. P. Merchantable grade		PLYWOOD Rail freight increment (See note for base price)	
	All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)									up to 20 ft.			
	1x6 S4S	1x8 S4S	2x4 S4S	2x6 S4S	2x8 S4S	2x10 S4S	3x12 R/Sh	6x12 R/Sh	12x12 R/Sh	2x12 R/Sh	12x12 R/Sh	5/16"	1/2"
Atlanta	**$40.00**	**$40.00**	**$32.00**	**$35.00**	**$34.00**	**$37.00**	**$46.00**	.....	.....	$57.00	$64.00	$17.90	$21.85
Baltimore	**44.00**	**46.00**	**44.00**	**46.00**	**47.00**	**52.00**	**65.00**	.....	.....	115.00	120.00	18.25	22.25
	48.00	*49.00*	*55.00*	*55.00*	*55.00*	*57.50*	*68.00*	*$76.00*	*$75.00*	.....	.....	.....	.....
Birmingham	**45.00**	**45.00**	**44.50**	**43.50**	**44.50**	**47.50**	**68.00**	**55.00**	**56.00**	.....	.....	17.35	21.15
[1]	50.00	50.00	49.50	48.50	49.50	52.50	72.00	.....	.....	67.50	70.00	.....	.....
Boston	60.00[2]	60.00[2]	60.00[2]	60.00[2]	60.00[2]	62.00[2]	66.00[2]	.....	.....	58.00[2]	58.00	18.25	22.25
	55.00	*55.00*	*54.00*	*54.00*	*54.00*	*54.00*	*58.00*	*58.00*	*58.00*	.....	.....	.....	.....
Chicago	**54.00**	**54.00**	**55.00**	**54.00**	**54.00**	**60.00**	**68.00**	.....	.....	80.00*l*	95.00*l*	14.60	17.80
	55.00	*55.00*	*54.00*	*54.00*	*54.00*	*55.00*	*66.00*	*66.00*	*57.00*	.....	.....	.....	.....
Cincinnati	**47.50**	**49.00**	**42.50**	**42.50**	**42.50**	**44.50**	**67.00**	.....	.....	65.00	65.00	17.35	21.15
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cleveland	**42.50***k*	**42.50***k*	**52.50***k*	**51.00***k*	**65.00**	**65.00**	**83.00**	**83.00**	**83.00**	.....	.....	17.75	21.60
Dallas	**45.25**	**45.25**	**44.50**	**43.00**	**43.00**	**47.25**	**60.75**	**58.75**	**58.75**	88.75	85.00	14.60	17.80
Denver ‡	68.00[4]	68.00[4]	64.75[4]	65.25[4]	63.75[4]	64.75[4]	68.75[4]	*72.00*	*72.25*	.....	.....	10.45	12.70
Detroit	**61.00**	**61.00**	**57.75**	**57.75**	**57.75**	**63.75**	**71.00**	.....	.....	70.75	90.00	17.35	21.15
	57.00	*57.00*	*57.00*	*57.00*	*62.75*	*72.75*	*75.00*	*75.00*	*90.00*	.....	.....	.....	.....
Kansas City	**69.00**	**69.00**	**67.00**	**65.50**	**67.00**	**69.00**	**84.00**	.....	.....	84.00	94.00	12.60	15.40
	68.00	*68.00*	*59.50*	*59.50*	*59.50*	*59.50*	*75.00*	*80.00*	*80.00*	.....	.....	.....	.....
Los Angeles	*60.00*	*60.00*	*60.50*	*60.75*	*59.25*	*59.25*	*72.75*	*72.00*	*72.00*	.....	.....	9.90*gh*	12.05*gh*
Minneapolis	*b* 62.00[4]	61.00[4]	.....	.....	.....	.....	.....	.....	.....	.....	.....	12.60	15.40
‡	*69.00*	*69.00*	*60.00*	*61.00*	*59.00*	*60.00*	*61.00*	*65.00*	*65.00*	.....	.....	.....	.....
Montreal	†[7] *84.00*	*65.00*	*60.00*	*63.00*	*65.00*	*70.00*	.....	.....	.....	200.00	200.00	.....	.....
	54.00	*54.00*	*57.00*	*57.00*	*57.00*	*58.75*	*80.00*	*80.00*	*80.00*	.....	.....	.....	.....
New Orleans	**40.00**	**40.00**	**37.00**	**35.00**	**34.00**	**36.00**	**46.00**	.....	.....	55.00	69.00	14.60	17.80
	31.00	*31.00*	*33.00*	*31.00*	*34.00*	*32.00*	*33.00*	.....	.....	.....	.....	.....	.....
New York	**67.50**	**67.50**	**62.50**	**62.50**	**62.50**	**64.00**	**74.00**	.....	.....	120.00*f*	125.00*f*	18.35	22.25
‡	.....	.....	*65.00i*	*65.00i*	*65.00i*	*65.00i*	[Range from $75 to $95]			.....	.....	.....	.....
Philadelphia	**75.00**	**75.00**	**75.00**	**75.00**	**75.00**	**75.00**	**75.00**	.....	.....	130.00	130.00	18.25	22.25
	75.00	*75.00*	*75.00*	*75.00*	*75.00*	*75.00*	*85.00*	*90.00*	*90.00*	.....	.....	.....	.....
Pittsburgh	**50.80**	**53.20**	**62.75**	**55.00**	**60.85**	**62.50**	**76.25**	.....	.....	.....	.....	18.10	22.05
	69.20	*68.10*	*66.10*	*65.30*	*65.20*	*65.65*	*82.75*	*88.75*	*88.75*	.....	.....	.....	.....
St. Louis ‡	*c* **61.00**	**61.00**	**57.00**	**56.00**	**57.00**	**59.00**	**71.00**	*75.00*	*75.00*	87.00	87.00	14.60	17.80
San Francisco	*d* *41.00*	*41.00*	*36.50*	*36.75*	*35.75*	*35.75*	*37.50*	*36.00*	*36.00*	.....	.....	7.30*g*	8.90*g*
Seattle	*51.25*	*51.25*	*45.75*	*45.75*	*44.50*	*44.50*	*47.00*	*47.75*	*46.50*	.....	.....	0.00	0.00

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf. [2] Roofers [3] Spruce. [4] Native. [5] Western Pine, No. 3 Common. [7] Spruce. [8] Norway Pine. ‡ Delivered. *a* Yard prices. *b* Contractors discount in Minneapolis and St. Paul discontinued May 21, 1938. *c* 5M ft. or less. *d* F.o.b. cars San Francisco freight rate. *e* 10% discount taken off. *f* Up to 18 ft. † Plus sales tax.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on 5/16", $95.15; on 1/2", $104.85; price includes oiling and sealing charges. For other centers add rail freight increment from table or proper size. For resin dipped treatment, add $10.50 per M. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* Ranges from $65 to $75. *j* Average price. *k* August 1943 price. *l* September price; none later available.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS— Discounts from jobbers list, Aug. 15, 1938 Single or Double Thickness		EXPLOSIVES— Per lb. 40% Ammonia Gelatin in 50-lb. cases delivered in 200 lb. lots*	
	A quality	B quality		
Atlanta	74%	75%	$0.15	
Baltimore	78%	79%	.15	
Birmingham	76%	76%	.105	
Boston	77%	78%	.15	
Chicago	77%	77%	.15	
Cincinnati	77–10%	77–10%	.15	Price of 60% Ammonia Gelatin in $0.01 per lb. higher than 40%
Cleveland	77%	77%	.19	
Dallas	76%	76%	.1625	
Denver	76%	76%	.155*c*	
Detroit	77%	77%	.1575	
Kansas City	77–10%	77–10%	.155	
Los Angeles	86%*d*	88%*d*	.1575	
Minneapolis	77%	77%	.155	
Montreal	40–10–2%*ab*	50–2%*ac*	.1675†	
New Orleans	70%	75%	.16	
New York	81%	82%	.22*f*	
Philadelphia	78%	79%	.15	
Pittsburgh	79%	79%	.1225	
St. Louis	77–10%	77–10%	.155	
San Francisco	66%	73%	.155	
Seattle	75%	75%	.1575†	

a Discount from list Sept. 1939; sales tax included, but 6% tax exemption not allowed for. *b* Single thickness. *c* Double thickness. *d* Discount from jobbers' list Sept. 15, 1928.

* Urban prices influenced by service charges or local storage and delivery regulations, do not consistently reflect quantity prices in less congested areas. *e* F.o.b. Louviers, Colo. *f* In boroughs of Kings, Queens and Richmond, and in Manhattan south of Canal St. add delivery charge of $6.00 per trip. [1] F.o.b.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.105	$0.13	$0.15
W. of Miss. to Rocky Mtn. States, Fla. and Maine.	.11 –.1175	.135 –.1475	.155 –.1675
Rocky Mtn. States	.11 –.1225	.135 –.1525‡	.155 –.1725‡
Pacific N. W. States	.1075–.12	.1375–.15	.1575–.17
Pacific S. W. States	.1050–.1125	.135 –.1425	.155 –.1625

‡ F.o.b. Louviers, Colo., or Butte, Mont.

PILES TIES— F.O.B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk.

Dimensions	Points	Length	By Rail— Pine*	By Rail— Fir
12-in. at butt	6-in.	30 to 50-ft.	$0.34	.....
12 in.— 2 ft. from butt	6-in.	50 to 59-ft.	.35	.....
12-in.— 2 ft. from butt	6-in.	60 to 69-ft.	.36	.....
12-in.— 2 ft. from butt	6-in.	90 to 100-ft.	....	.5575
13-in.— 3-ft. from butt	5-in.	91 to 100-ft	....	.5608
14-in.— 2-ft. from butt	6-in.	50 to 69-ft.	.41	.6175
14-in.— 2-ft. from butt	6-in.	70 to 79-ft.	.43	.59
14-in.— 2-ft. from butt	5-in.	80 to 85-ft.	.54	.....
14-in.— 2-ft. from butt	5-in.	85 to 89-ft.	.57	.....
14-in.— 2-ft. from butt	5-in.	90 to 100-ft.	....	.60

* Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

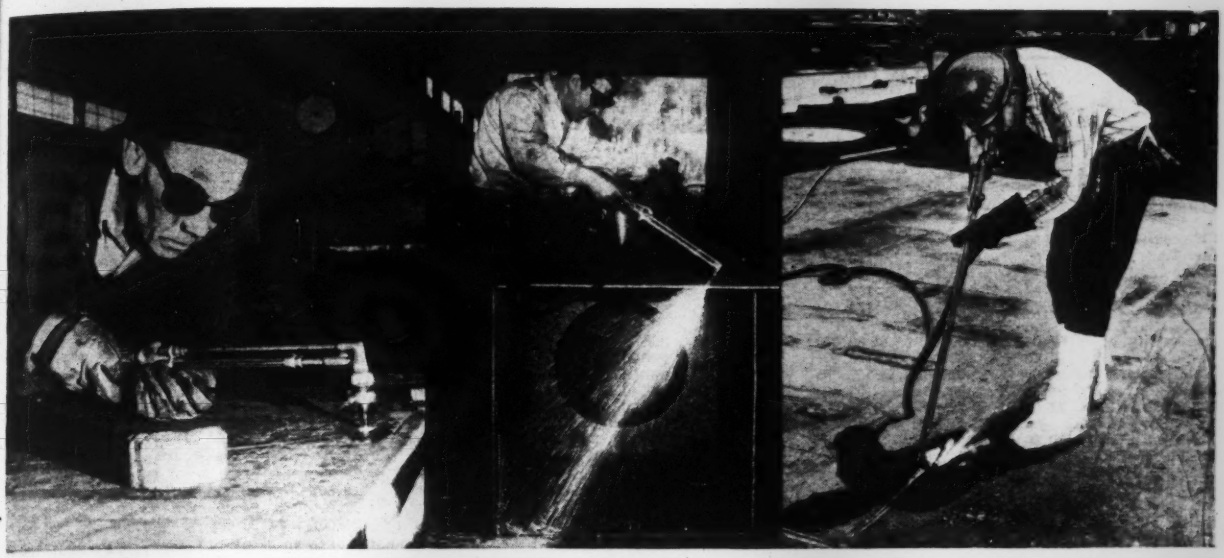
Prices f.o.b., per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'6" Untr.	7"x9"x8'6" Tr.
Boston	Oak	$1.50	....	$2.00	....
	Pine	2.00	$3.00*a*	2.50	$3.00*a*
New York	S. L. Sap Pine	1.43/1.54	2.59	1.76	2.86
	Mixed Oak	1.71	2.59	2.42	3.58
Birmingham	White Oak	1.00	1.60*a*	....	2.25*a*
Chicago	Red Oak	....	2.00/2.25*a*	....	2.87/3.00
Los Angeles	Douglas Fir	2.00	3.25*a*	2.90	4.70*a*
Philadelphia	Red Oak	....	2.10*ag*	....	3.25*ag*
St. Louis	White Oak	1.63	....	2.19	....
	Red Oak	1.63	2.20*a*	2.19	3.04*a*
	Sap Pine or Cypress	1.70	....	2.06	....
San Francisco	Douglas Fir	1.25*bef*	....	....	3.00*cf*
Montreal	Birch or Maple	....	....	.... †	.... †

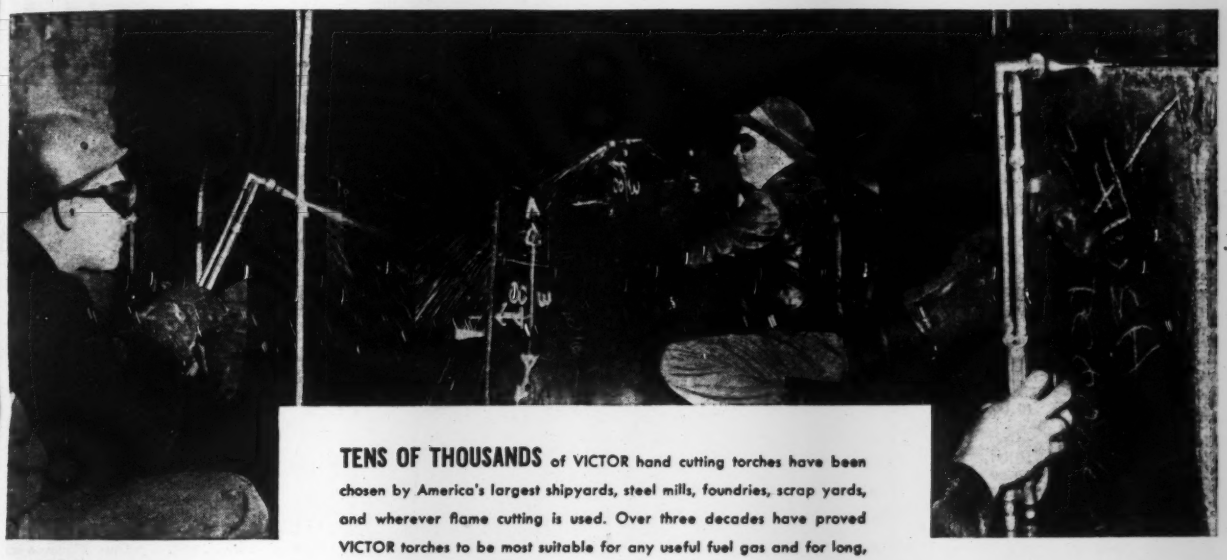
Tr.— Treated; Untr.— Untreated. *a* Creosoted. *b* 6"x8"x8'6". *c* Empty cell. *d* Zinc. *e* Green. *f* F.o.b. cars. † Out of market. *g* January 1943 price, none later available.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder, in drums, f.o.b. works, per 100-lb	$2.50– 3.10
Chlorine cylinders, liquid, per lb., delivered	.0525
Calcium chloride, 77–80%, flaked, 100-lb. paper bag, del'd, ton.	18.50–35.00
Silicate of soda, 52 deg. in drums, f.o.b. works, per 100 lb	1.40
Soda ash, 58%, in paper bags, per 100 lb. dense	1.15
Sulphate of aluminum, commercial, in 100-lb. bags, per ton	23.00–25.00
Sulphate of copper, in bbl., per 100-lb	5.00





TENS OF THOUSANDS of VICTOR hand cutting torches have been chosen by America's largest shipyards, steel mills, foundries, scrap yards, and wherever flame cutting is used. Over three decades have proved VICTOR torches to be most suitable for any useful fuel gas and for long, trouble-free and economical ownership.

VICTOR EQUIPMENT CO.
844 FOLSOM STREET
SAN FRANCISCO 7, CALIFORNIA

VICTOR

Ad 126

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE PARTITION — SCORED Per M lots of 2,000 pieces or over,			STRUCTURAL CLAY TILE — LOAD BEARING — SCORED Per M lots of 2,000 pieces or over,			BRICK Per M in quantity		LIME		
	3x12x12 in.	4x12x12 in.	8x12x12 in.	8x12x12 in.	10x12x12 in.	12x12x12 in.	Common backing	Straight hard	Per ton, Hydrated finishing	In paper, Common hydrated	Carload lot, Pulverized or Lump
Atlanta	$104.00	$114.00	$199.00	$234.00	$244.00	$250.00	$18.25	$20.04	$26.54	$15.04	$15.04
Baltimore	84.00	90.00	170.00	200.00	260.00	300.00	17.00*k*	21.00*k*	19.00	14.00	2.50*m*
Birmingham	80.00	85.00	160.00	191.00	252.00	288.00	16.50	23.00	18.11	13.64	3.25*k*
Boston	103.75*a*	110.65*a*	207.45*a*	248.90	.....	.....	20.00*i*	20.00*i*	21.00†	.....	16.00
Chicago	79.50	85.00	160.00	197.00	243.00	278.00	15.00	16.00	17.00	15.00	12.50
Cincinnati	65.55	69.90	131.20	148.70	210.35	240.45	25.75	25.75	15.50	13.00	
Cleveland	82.50	97.35	182.50	.....	.....	.....	20.00	20.00	15.75*j*	13.25*j*	3.00*u*
Dallas	71.40	76.70	145.30	183.50	238.00	294.50	15.25*i*	16.75*i*	19.00	15.00	15.00
Denver	84.80	95.40	153.70	178.20	212.00	227.90	14.50	18.00	25.00*j*	17.00*j*	20.00*j*
Detroit	92.70	96.70	174.50	198.80	257.20	294.30	20.50	20.50	18.00	16.00	16.00
Kansas City	67.00	69.00	89.00*c*	128.00	163.00	189.00	14.00	16.00	19.32	13.00	10.92
Los Angeles	73.50†*r*	89.50†*r*	128.00*c*†*r*	210.00†*r*	368.00†*r*	460.00†*r*	13.50	15.00	16.50	17.50	17.50
Minneapolis	87.00*b*	92.80*b*	157.30*b*	.....	189.00*b*	262.00*b*	25.50	27.50*g*	21.00	16.00	19.00
Montreal	94.55*a*	100.45*a*	199.50*a*	160.45*a*	109.40*at*	137.40*au*	23.80†*u*	33.02†*u*	24.60*s*	17.10*s*	20.00*s*
New Orleans	72.00	72.00	135.00	162.00	210.00	260.00	14.00	.....	18.30	12.08	14.10
New York	90.80	96.80	133.10*c*	219.80*h*	269.80*h*	333.90*h*	17.50/18.50*x*	.....	20.00	14.00	17.00
Philadelphia	104.20	111.20	208.40	250.10	305.10	377.70	18.75	21.75	19.00	16.00	15.00
Pittsburgh	74.20	79.15	148.40	233.00	284.00	325.00	21.25	23.25	17.90	15.40	2.55*m*
St. Louis	67.00	72.00	130.00	190.00	244.00	290.00†	20.50	19.50	22.00	18.00	2.50*m*
San Francisco	96.00	108.00	144.00	108.00*t*	.....	.....	21.50	.....	24.00	23.00	2.50*m*
Seattle	115.00	125.00	230.00	.....	.....	.....	20.50*f*	24.00*f*	20.00*s*	20.00*s*	20.00*s*

† F.o.b. *a* Smooth. *b* Carload lots delivered to job. *c* 6x12x12 in., 3-cell. *d* Not load bearing. *e* 48 lb. tile. *j* Less $1.00, ½ cash 15 days, balance 30 days. *g* Selected common. *h* F.o.b. Perth Amboy, N. J. *i* F.o.b. Warehouse only. *f* LCL. *k* $1.00 discount if paid in 10 days. *l* Lump. *m* Per bbl., 180 lb. *o* Per bbl., 200 lb. *p* 280 lb. bag. *r* 5% discount 10 days. *s* 2% discount for cash. *t* 5½x8x12. *u* 8% sales tax included. *v* 6x12x12-in. *w* Per 200 lb. bag. *x* Price withdrawn; May 1945 quotation.

PAINT, ROOFING—F.O.B. CARLOAD LOTS

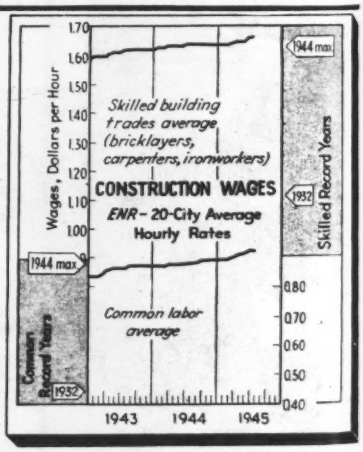
	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl Dry *a*	WHITE LEAD Per 100 lb. in oil	READY-MIXED PAINT Per gal., drums Graphite *b*	Aluminum *b*	Ferric Oxide *d*	ROOFING SUPPLIES Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb.	Carload lots f..o.b.. factory Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 350 lb. bbl. per ton
Atlanta	$10.25	$14.125	$1.30	$2.25	$1.20	$1.85	$1.72	$1.72	$0.305	$27.00
Baltimore	10.00	13.75	2.00	3.00	2.50	2.30	2.70	2.70	.40	29.00
Birmingham	10.25	14.125	2.35	3.50*r*	1.98*r*	2.09	1.98	1.98	.32	28.35
Boston	10.00	13.75	1.75	2.50	2.31	2.00‡*h*	3.30‡*uv*	3.30‡*uv*	.25‡	21.00‡
Chicago	10.00	13.75	....	....	....	1.75*hf*	1.74*hf*	1.82*hf*	.33*f*	23.00*f*
Cincinnati	10.00	13.75	1.70	2.90	1.60	2.20	2.10*h*	2.10*h*	.33	25.00
Cleveland	10.00	13.75	1.70	2.90	1.60	1.71	1.63*h*	1.63*h*	.237	25.00
Dallas	10.00	14.50	1.88	2.11*n*	.05*l*	1.75*h*	1.66*h*	1.66*h*	.35	39.00
Denver	10.50	14.25	....	....	.27*l*	2.45	2.95	2.95	.35	28.00
Detroit	10.00	13.75	1.75	3.00	1.60	2.25	2.25	2.25	.50	23.00
Kansas City	10.00	13.875	2.30*g*	2.55*gr*	2.16*g*	2.19	2.30	2.30	.28	27.50
Los Angeles	10.25	14.25	1.60	2.25	2.30	2.10	1.50	....	.45	.....
Minneapolis	10.00	13.875	....	....	....	1.7123*i*	1.6243*hi*	1.6243*hi*	.32	23.00
Montreal	.....	11.05	2.50*p*	4.90*p*	3.15*p*	4.02*t*	2.58*t*	3.01*t*	.89*t*	2.10*kt*
New York	10.00	13.75	2.03	....*r*	1.82	1.7098	1.6273*a*	1.6273*a*	.26	23.00
Philadelphia	10.00	13.75	1.60/1.80	2.20*r*	1.55	2.25	2.71	2.71	.32	23.00
Pittsburgh	10.00	13.75	1.05	1.95	.80	1.95	1.84*h*	1.84*h*	.34	26.00
St. Louis	10.00	13.75	2.28*s*	2.89*s*	1.96*s*	1.92	1.66	1.66	.36	24.00
San Francisco	10.25	14.00	1.80	2.75*n*	1.35	1.71	2.40	2.40	.33	20.50
Seattle	10.25	14.25	1.90	3.00	....	2.15	2.16*h*	....	.35	26.50*j*

‡ Delivered. Note: Red lead in oil 50c. higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* Subject to 25% discount. *f* Distributors' price to contractors. *g* 5 gal. can. *h* Per roll, 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per 100 lb *l* Per lb. *m* Per bbl. *n* May, 1941 price. *o* 60-lb. roll. *p* Plus 8% sales tax *r* Not available, except on priority rating; then quoted specially. *s* December 1942 price. *t* Federal tax included. *u* 90-lb. roll. *v* Truck delivery.

SKILLED AND COMMON WAGE RATES—PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor Building	Common Labor Heavy Const.
Atlanta	$1.50	$1.25	$1.50	$1.25	$1.50	$0.40	$0.50
Baltimore	1.75	1.4375	1.80	1.625/2.00	1.725	.80	.80
Birmingham	1.75	1.25	1.625	1.375 /1.625	1.65	.65	.65
Boston	1.625	1.50	1.675	1.50 /1.875	1.667	1.00	1.00
Chicago	1.90	1.70	1.85	1.75	1.825	1.20	1.20
Cincinnati	1.825	1.60	1.725	1.45 /1.60	1.75	.90	.90
Cleveland	1.875*c*	1.575	1.875	1.875	1.875	1.085	1.125/1.155
Dallas	1.625	1.25	1.50	1.75	1.625	.60	.75 /1.25
Denver	1.80*b*	1.50*b*	1.50*b*	1.50 /1.625*b*	1.65	.80*b*	.80*b*
Detroit	1.725	1.50	1.825	1.675/1.825	1.725	1.00	1.00
Kansas City	1.75	1.50	1.625	1.675	1.75	.975	.90
Los Angeles	1.50	1.35	1.625	1.375	1.667	.875	.875
Minneapolis	1.625	1.44	1.625	1.50	1.625	.95	.95
New Orleans	1.625	1.375	1.625	1.55	1.50	.70	.80
New York	2.00*b*	1.85*b*	2.00	2.00*b*	2.00*b*	1.10	1.10
Philadelphia	2.00	1.58	1.90/2.00	2.25	2.00	.90	.90
Pittsburgh	1.90	1.75	1.75	1.8125	1.875	1.00	.90
St. Louis	1.93	1.75	1.75	2.00	1.75	1.00	1.00
San Francisco	1.875	1.50	1.75	1.50/1.75	1.75	1.00	1.00
Seattle	1.845	1.545	1.745	2.00	1.845	1.145	1.145
Montreal*	1.06	.96	1.01	.91	1.06	.61	.66

b 7 hr. day. *c* Prevailing rate on government work.
* Cost of living bonus now including in basic wage.



ENR Skilled Average; (Bricklayers, Carpenters, Ironworkers) **$1.665.**
ENR Common Average; $0.916.

(Continued from page 92)

British can construct 200,000 homes in 2 years

With proper organization and with the adequate release of labor, there should be sufficient supplies of materials, with the probable exception of lumber, to meet the requirements of a building program for Britain of about 200,000 houses in two years after V-E Day. This was the finding of a committee of the Royal Institute of British Architects, appointed to examine the question of housing production in detail, as reported in a recent issue of the *Journal* of that society.

The committee pointed out, however, that the program will be one of increasing output, reaching a maximum at the end of the second year.

This committee report is timely because the Minister of Works has announced that the policy of providing temporary housing has, in the main, been abandoned, and that emphasis is to be placed on houses of a permanent character. However, materials supply will be the governing factor.

If the fact has to be accepted that very little or no lumber will be available during the first two years, then the only alternative material in the opinion of the committee is concrete. In the case of floors, provision could be made in the design for the laying of wood block flooring at a later date. It would also be possible in the case of pitched roofs to use alternative materials, such as steel trusses.

Training of labor

Besides the materials situation, the shortage of labor was also examined. The committee placed considerable importance on the differentiation between precision workers and labor sufficiently trained to deal with house production under adequate supervision. In the government scheme in which 20 months is allotted for the complete training of an apprentice, it is believed that the trainee should be available at the end of four months for work of a less skillful character, such as the simple tasks involved in the building of small houses.

Prefabrication is regarded by the committee as a long-term policy that will supplement and possibly in the course of time take the place of well-tried methods of building.

• • •

Regional meetings plan Kansas postwar roads

A $26,000,000 road building program for Kansas scheduled to start the first year after the end of the war is being mapped and organized at 21 regional meetings over the state.

The program calls for highway construction totalling $50,000,000 for the first three years after the war. Of this amount, $5,000,000 annually is to come from federal aid for the state system —approximately $4,000,000 for secondary roads, and over $1,000,000 for urban connections on major highways.

According to state highway engineers, Kansas plans to get the secondary highway work started at the earliest possible moment after hostilities are at an end.

Road repair work

L. L. March, maintenance engineer of the state highway commission, expects

This wall erected by Prison Labor, Division of West Virginia State Road Commission at Short Creek, Ohio County airport, for Flood Protection. Wall is 12 ft. high, 550 ft. long and erected in 15 working days.

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to begin at once to repair state roads damaged by recent high waters and heavy wartime traffic. Included in the projects are 822 mi. of resurfacing contracts carried over from last year, $495,968; 2,109 miles of gravel, stone and bituminous resurfacing, $1,588,961, approved and advertised to June 15; 1,145 mi. of gravel, stone and bituminous resurfacing, $855,000 to be contracted to December 31; bituminous reconstruction and mat resurfacing of 330 mi., $1,238,208, and 99 mi. of bituminous reconstruction and mat resurfacing to be contracted to December 31, $382.000.

• • •

Washington county road funds now assured

Governor Mon C. Wallgren of Washington, recently signed a bill providing much needed funds for county road construction and maintenance.

Under Washington's long-standing limitation of taxation by state and municipal governments to 40 mills on the dollar of assessed valuation in any one year, county road districts had been limited to what some county commissioners regarded as a "starvation diet."

This measure more than trebles fund allocations for road construction by increasing the limitation on road district levies from three to ten mills. Its signing marked the successful conclusion of more than four years' efforts on the part of good roads groups to obtain additional funds for county-maintained roads through an enabling act empowering county officials to levy special road assessments.

• • •

N. C. highway engineers to get salary increases

The North Carolina Highway and Public Works Commission has approved a new wage and salary schedule for highway division employees, including substantial increases in pay for members of the engineering staff.

Chairman A. H. Graham said the highway department's salaries "are much lower than those of private industry and as a result we are placed at a tremendous disadvantage in obtaining additional trained men. The increases are designed to meet the competition."

A revision of salaries and wages in the highway division was authorized by the recent session of the North Carolina legislature. The new schedule will include the old war bonus, which the 1945 legislature made part of state employees' salaries, in addition to the increases authorized by the legislature.

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MD.... Baltimore—Phillips Machinery & Tractor Co.
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MICH.. Bark River—Bark River Culvert & Equipment Co.
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Wolverine Tractor & Equipment Co.
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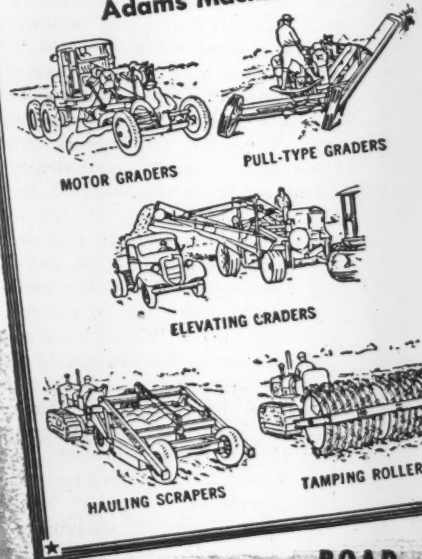

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Elections and Activities

New officers of the Engineers Club of Western North Carolina are: Lee M. Bauer, president; W. M. McCulloh, vice president; G. I. Thurmond, treasurer; W. W. Dodge, Jr., secretary; and Hyman Dave and Herbert F. Finck, directors.

Alexander M. Beebe, vice-president of Rochester Gas & Electric Corp., has been elected president of the Rochester, N. Y., Engineering Society.

Other officers are: Walker S. Lee, first vice-president; Earl Karker, second vice-president; Howard Harding, treasurer; J. Howard Cather and John V. Lewis, directors for three years.

E. W. Schilling, dean of engineering at Montana State College, Bozeman, has been elected president of the Montana Society of Engineers. Other officers are C. H. Steel of Butte, first vice-president; E. A. Barnard, Anaconda, second vice-president; Fred Schwanz, Butte, secretary-treasurer; R. E. Gibbs, Bozeman, and F. C. Jaccard, Butte, trustees.

E. D. Emigh, meteorologist in charge of the local weather bureau, is the new president of the Montgomery, Ala., Engineers Club.

Other officers are S. W. Harbin, first vice-president; John F. Freeman, second vice-president; Clayton H. Hardison, third vice-president; and Herbert I. Moeller, secretary.

Francis S. Friel has been installed for his second term as president of the Philadelphia, Pa., Section, American Society of Civil Engineers. Other officers are: Professor Howard K. Preston, of the University of Delaware, vice-president; and Joel D. Justin, Philadelphia consulting engineer, Lawson D. Matter, Harrisburg, Pa., district engineer of the Pennsylvania State Department of Health and Carlos D. Bullock, associated with the Philadelphia office of the Portland Cement Association, directors; Ralph Earle of Thomas Earle and Sons, contractors, was named assistant secretary and Neville C. Courtney, associated with the office of Joel D. Justin, was named assistant treasurer. Officers continuing the second year of elected terms are George H. Zeisler, of Henry W. Horst Co., contractors, as a director; Lemuel F. Parlette, assistant chief engineer of the Philadelphia Transportation Co., as a vice-president and Charles A. Howland, chief of the Division of Projects, Philadelphia City Planning Commission, secretary and treasurer.

J. M. M. Lamb has been elected chairman of the St. John, N. B., branch of the Engineering Institute of Canada, succeeding C. D. McAllister. The vice chairman is Maj. W. B. Akerley; E. J. Ball is secretary-treasurer. R. M. Richardson and J. P. Campbell were named to the executive committee.

New members of the Indiana State Board of Registration for Professional Engineers and Land Surveyors, named by Gov. Ralph Gates are: Walter A. Walb, American Steel Dredge Co., Fort Wayne; Harry L. Solberg, Lafayette, and Guy Stinchfield, Valparaiso. Renamed were C. C. Knipmeyer, Terre Haute, and R. V. Achatz, Aurora.

Leo M. Bauer of Brevard, N. C., has been elected president of the Engineers Club of Western North Carolina. He succeeds Floyd E. Cotton. Other officers elected are: M. W. McCullough, vice president; W. W. Dodge, secretary; G. I. Thurmond, treasurer; and Herbert F. Finck and Hyman Dave, directors.

Leslie A. Jackson, manager of the municipal water works, Little Rock, Ark., has been elected secretary-treasurer of the Southwest Section of the American Water Works Association, succeeding George J Rohan, of Waco, Tex., who recently resigned.

A number of cities and counties in the State of Washington are preparing postwar construction programs. Seattle has approximately $2,500,000 assured for such a program and may increase this amount if bond issues are voted. In addition, other work will be financed by the city-owned lighting, water and transit utilities and by the state gasoline tax fund. A postwar public work and improvements advisory commission is preparing a 5-year program while the city planning commission is working upon a program of broader scope that involves long-range planning for the city's general development. The first commission has drafted a program of projects aggregating $35,820,190 in estimated cost. Liaison between the two groups is provided through Henry R. Berg, staff assistant of City Engineer Charles L. Wartelle, who acts as engineering expert to the postwar project planners and as executive secretary for the planning commission.

Spokane County is studying a program estimated to cost $2,500,000, while Snohomish County has compiled a tentative postwar program of $1,500,000.

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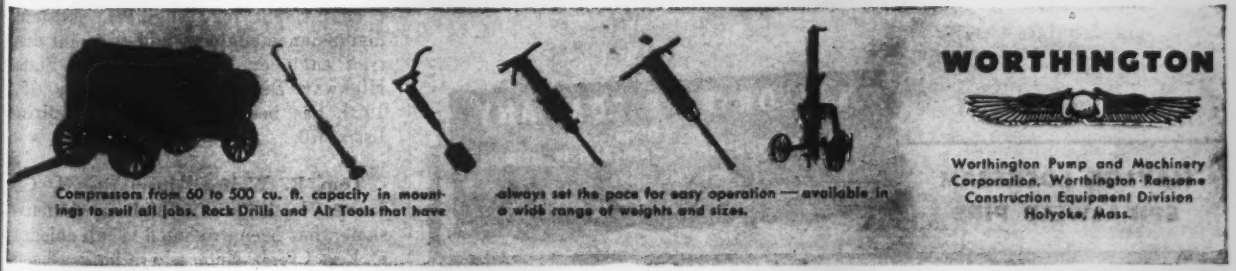

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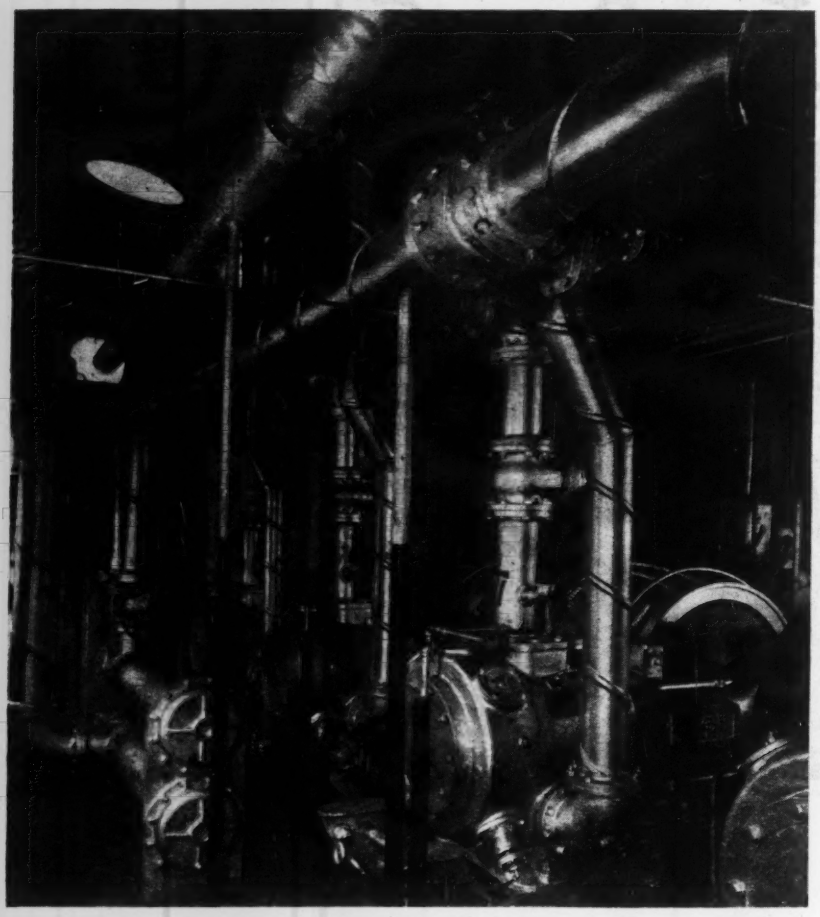

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Men and Jobs

Arthur W. Tews, project engineer with the Minnesota State Highway Department for twelve years, has been appointed Duluth city engineer, replacing **Frank McComber. Mr. Tews** has been in charge of construction on a number of the state highway improvements in Duluth and vicinity since 1933. He was graduated from the civil engineering school of the University of Minnesota in 1924.

Leslie W. Mahone, formerly supervisor of the Iowa Merit System Council, Des Moines, Ia., has opened an engineering office in Clear Lake, Ia. He has a B. S. in civil engineering and an M. S. in highway engineering from Iowa State, Ames, Ia., and was for seven years assistant professor, Engineering Extension Service, at Iowa State.

Brig. Gen. M. C. Tyler, president of the Mississippi River Commission, Vicksburg, Miss., has received the Legion of Merit award for leading the Army's huge construction program in the Lower Mississippi Valley during 1942.

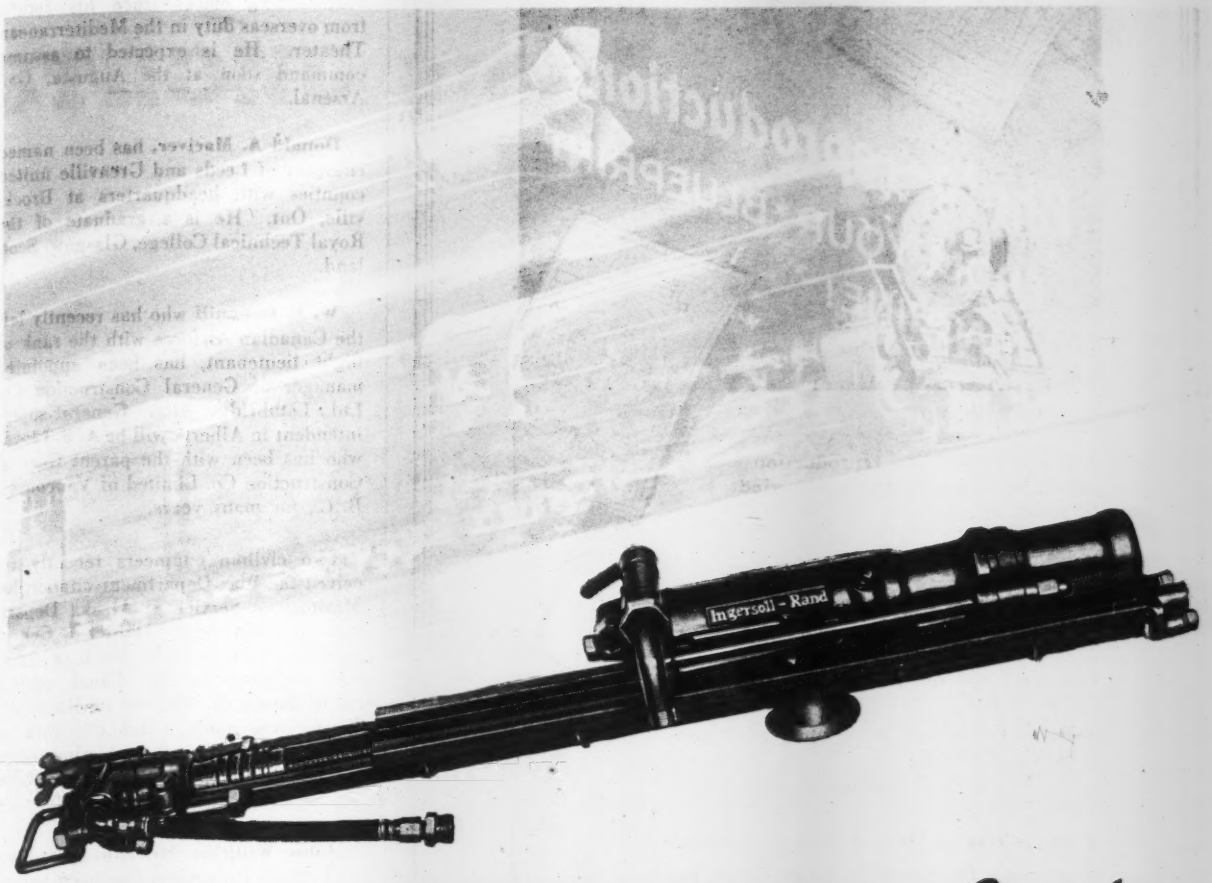
Elmer A. Jacobs, former city engineer of Provo, Utah, and secretary of the Provo River Water Users' Association, has been named superintendent of the Provo City Utilities Department to succeed Ray Rinderhagen, resigned.

Lt. Gilbert B. Lee, Portland, Ore., has been assigned to a course of study in civilian government as training for occupation duties. He has served with the Combat Engineers of the 5th Army in Italy since March, 1944.

These four district bridge engineers have been appointed by Charles M. Ziegler, Michigan State Highway commissioner: **L. D. Abbey,** Grand Rapids district; **Maynard D. Bailey,** Saginaw district; **Harold J. Conroy,** Cadillac district; and **Paul Ueberhorst,** metropolitan district.

Maj. Spencer J. Stewart, who has been resident road engineer, assistant maintenance engineer and assistant district engineer, in the Michigan State Highway Department since May 15, 1920, has been placed on the retired list at 70.

Tom R. Wolfe, Albemarle, N. C., former North Carolina highway commissioner, has been promoted to full colonel at Fort Crook, Neb., where he has been



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This work had to be done without delaying movement of wartime freight and passengers. A regular operating cycle could not be used—blasting was controlled by the train dispatcher. Good organization and efficient use of equipment, however, made up for the loss of construction time caused by heavy train schedules. DA-35 Power-Feed Drifters were selected for the drilling. Here, as in many tunnels and mines throughout the country, the record-breaking drilling speed and durability of these machines helped push the job to speedy completion.

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commanding officer since his return from overseas duty in the Mediterranean Theater. He is expected to assume command soon at the Augusta, Ga., Arsenal.

Donald A. Maciver, has been named engineer of Leeds and Grenville united counties with headquarters at Brockville, Ont. He is a graduate of the Royal Technical College, Glasgow, Scotland.

W. E. Gemmill who has recently left the Canadian Airforce with the rank of flight lieutenant, has been appointed manager of General Construction Co. Ltd., Lethbridge, Alta. General superintendent in Alberta will be **A. S. Lloyd,** who has been with the parent General Construction Co. Limited of Vancouver, B. C., for many years.

Two civilian engineers recently received the War Department citation for Meritorious Service at Alaska Department Headquarters. **Daniel J. Gee** of Seattle was cited for his work as cadastral engineer for the Canol project while **James W. Huston** of Raymond, Wash., was honored for his work as engineer in charge of conducting reconnaissances for port terminal facilities at Anchorage and Juneau.

John Williams McBean, a graduate of Toronto University, has been named resident engineer of the Ontario Department of Mines at Swastika, Ont.

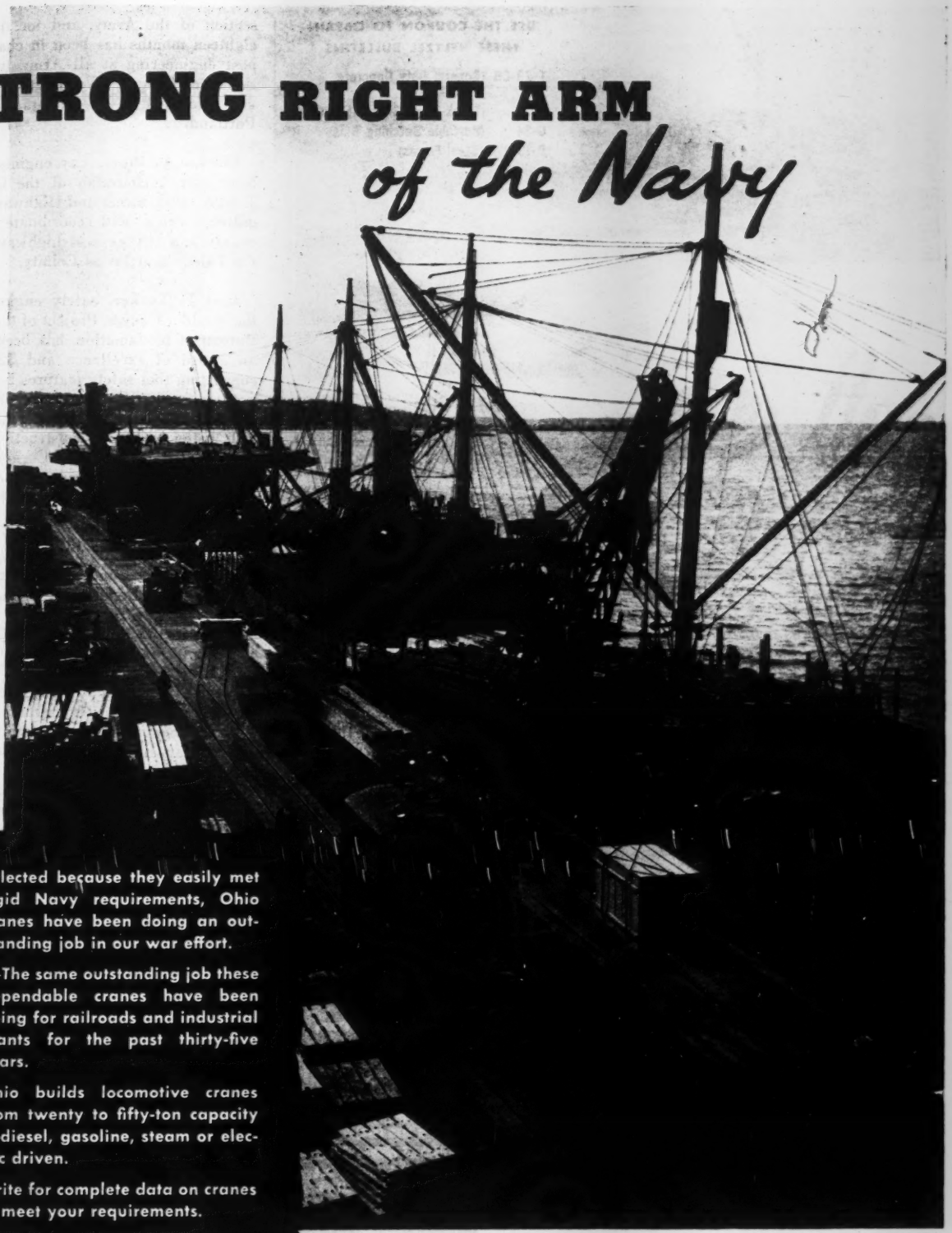
Alfred H. Fletcher, for the past four years associate in the department of sanitary engineering, School of Hygiene and Public Health, The Johns Hopkins University, has joined the New York City Department of Health as assistant to Sol Pincus, senior sanitary engineer. Prior to his work at Johns Hopkins, Mr. Fletcher was director of the Bureau of Sanitary Engineering in the Memphis, Tenn., Department of Health for twelve years.

E. I. Wood, Jr., who prior to entering the Army in December 1942, was supervisor of the engineering department of the state WPA office at Raleigh, N. C., has been promoted to first lieutenant in the Army Corps of Engineers in the South Pacific.

Maj. Robert Lee DuBose of Atlanta, Ga., is post engineer at the Laurinburg-Maxton Army Air Base at Maxton, N. C.

Col. Walter E. Church has returned to private business in Portland, Ore., after three years with the armed service. He has been in the camouflage

STRONG RIGHT ARM *of the Navy*



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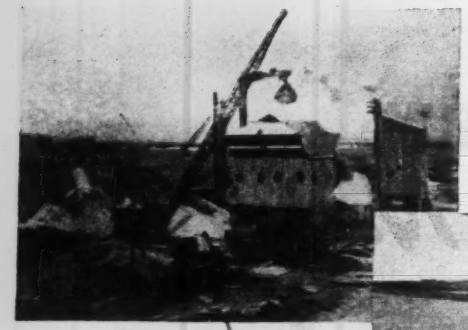

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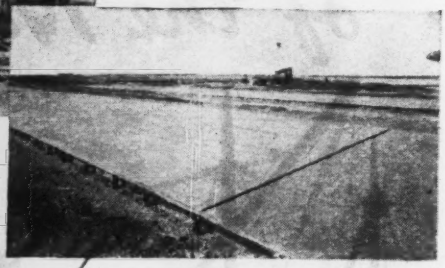
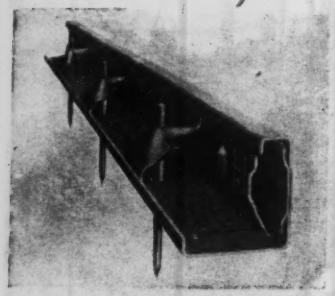
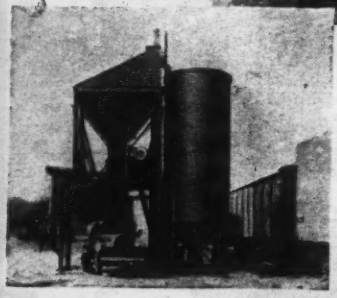


call Heltzel





● Prepare for the "go-ahead" signal on concrete construction by writing or calling Heltzel now. Ask for these engineering-styled, easy-to-read, easy-to-use, Heltzel bulletins:

T-29-CB (General Duty Concrete Buckets)
B-31 (Truck Mixer Charging Plants)
C-34 (Portable Batching Bins)
B-19 (Steel Forms)

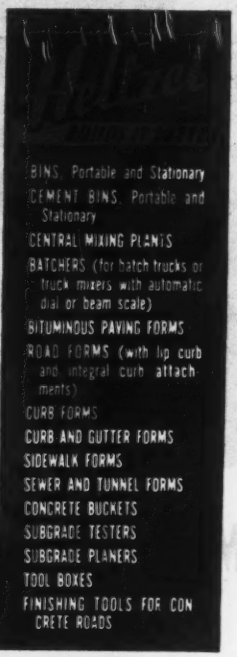
Name_____

Address_____

_____

_____

(Type of construction usually engaged in)


BINS, Portable and Stationary
CEMENT BINS, Portable and Stationary
CENTRAL MIXING PLANTS
BATCHERS (for batch trucks or truck mixers with automatic dial or beam scale)
BITUMINOUS PAVING FORMS
ROAD FORMS (with lip curb and integral curb attachments)
CURB FORMS
CURB AND GUTTER FORMS
SIDEWALK FORMS
SEWER AND TUNNEL FORMS
CONCRETE BUCKETS
SUBGRADE TESTERS
SUBGRADE PLANERS
TOOL BOXES
FINISHING TOOLS FOR CONCRETE ROADS

HELTZEL STEEL FORM & IRON CO.
WARREN, OHIO · U. S. A.

section of the Army, and for the last eighteen months has been in charge of post engineering at all Army installations in Oregon, Washington, Idaho and Montana, with headquarters at Portland.

Clayton L. Piper, city engineer, has been named chairman of the Greater Toledo, Ohio, Street and Highway Committee, which will coordinate state, county and city express highway plans for Toledo and Lucas County.

Earl F. Tucker, safety engineer on the Boulder Canyon Project of the U. S. Bureau of Reclamation, has been given an award of excellence and $250 for suggesting that safety features be incorporated in the drafting stage of structural designs to prevent accident hazards being built into construction. Mr. Tucker (a graduate of Cornell University's School of Engineering) has been associated with the Boulder Dam project since 1935.

Harry E. Metcalf, chief engineer of the maintenance and repair bureau in the Ohio State Department of Highways for six years, is transferring to a similar position in the Kentucky State Department of Highways.

Maj. K. G. Francis, former engineer of the Beauharnois Construction Co., Ltd., has been named officer commanding Military District No. 5, Quebec.

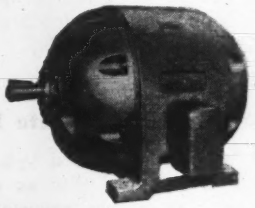
R. G. McCrady, for the past six months acting as assistant superintendent of the city water works at Vancouver, B. C., has been appointed superintendent. He succeeds **James Whyte,** superannuated.

Three employees of the Upper Mississippi Valley Army Division Engineer's Office, St. Louis, Mo., were given the Emblem of Meritorious Civilian Award recently by Col. Malcolm Elliott, division engineer. Cited were **Joseph E. Jewett,** assistant to the chief engineer; **John T. Sturm, Jr.,** head of the division's hydraulics and reports section, and **Bert J. Hoare,** head of the division's safety section.

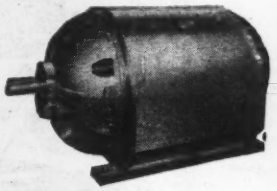
Reorganization of the Utah Highway Department and staff changes were announced recently by **Chief Engineer Roy W. McLeese,** who was appointed to the reestablished position in April. **Thomas Heath,** former resident engineer at Salt Lake City, has been placed in charge of District No. 2 with headquarters at Salt Lake City, replacing **William Core,** who has been named as engineer of District No. 3 at Richfield. Mr. Coer in turn replaces **R. W. Griffin,** new construction engineer.

NOW your *big drives* can have it* too!

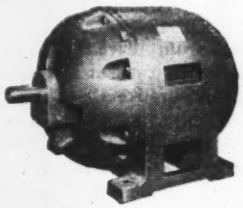
*The EXTRA protection of TRI CLAD construction



Typical, large-size, sleeve-bearing Tri-Clad polyphase motor, now standard up to 2000 horsepower



Modified cast-iron frame construction used for certain large sizes of the extended Tri-Clad motor line



Separable housing construction used for large-size ball- or roller-bearing Tri-Clad motors. Roller bearings are standard at coupling end

G-E STANDARD Tri-Clad Induction Motors Now Available to 2000 Hp.

For that important *big* drive (up to 2000 hp, 3600 rpm) you can now get a G-E standard Tri-Clad induction motor with all the protective features that have proved so valuable in the more widely used sizes.

● **1. EXTRA PROTECTION FROM PHYSICAL DAMAGE**

Cast-iron construction with upper portion completely enclosed to keep out falling objects, dripping liquids. Streamline, cast-iron end shields. Corrosion-resisting finish.

● **2. EXTRA PROTECTION FROM ELECTRICAL BREAKDOWN**

Windings of Formex wire are solidly bonded with synthetic resins that are strongly resistant to oil and moisture. Formex wire insulation stands up remarkably under abrasion or "heat-shock."

● **3. EXTRA PROTECTION FROM OPERATING WEAR AND TEAR**

Available with either sleeve or ball bearings—in dust-tight housings. Sleeve-bearing design is a further refinement of well-proved Tri-Clad motor bearing proportions, efficiently lubricated, with "air seal" to insure oil-tightness of the housing.

The Tri-Clad, in its wide range of types and sizes, is G.E.'s most widely used (integral-hp) motor. Chances are there's a Tri-Clad to meet your drive requirements "on the nose." Ask for Bulletin GEA-3580. *General Electric Company, Schenectady 5, N. Y.*

Here's Today's Wider Range of Standard Sizes	
TYPE K	1 hp to 2000 hp at 1800 rpm
TYPE KG (High starting torque, low starting current)	5 hp to 200 hp at 1800 rpm
TYPE KR (High starting torque, high slip)	Available to 100 hp in speeds required for high-slip, flywheel drive (punch presses, etc.)

NEW 2000-hp INDUCTION MOTOR LARGEST MEMBER OF TRI-CLAD FAMILY

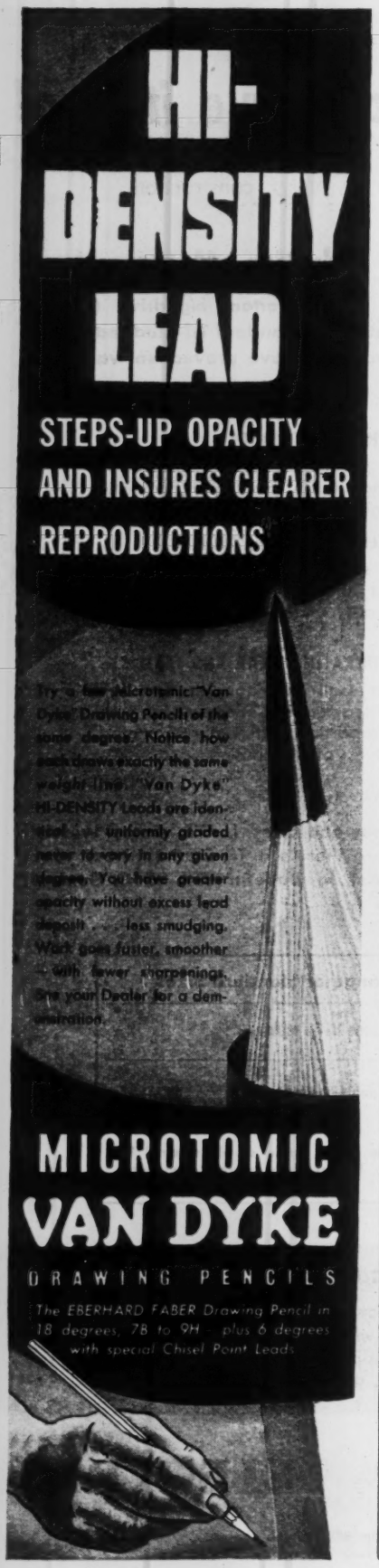
Dwarfing the original Tri-Clad motor (resting on the conduit box) in size, this new 2000-hp "big brother" embodies all of the same protective construction features. It operates at 1800 rpm, on 2300 volts, 60 cycles. This new 3-phase motor is in the 6360-frame series, which is five steps larger than the largest standard industry frame size (namely 505).

Special motors can be custom-built in Tri-Clad design for YOUR problem. Induction motors specially designed to the job can generally be built with many of the Tri-Clad motor's strong points, such as enclosed upper portion, smooth cast-iron end shields, windings of Formex wire, and double-end ventilation.

GENERAL ELECTRIC

750-264C-1590

Buy all the BONDS you can —*and keep all you buy*



New Aids to the Constructor

Paint Guide

Of convenient pocket size, and working on the principle of a slide rule, a new Valdura paint guide, with only two settings, will give correct surface preparation and proper priming and finishing coats. It makes available information on the properties of the manufacturer's line of paints, and all application data.

Specific information may be found, with this guide, on resistance of recommended material to heat, acid, alkali, moisture, abrasion, sun and oil; also coverage and drying time, and the proper thinner.—*American-Marietta Co., 43 East Ohio St., Chicago, Ill.*

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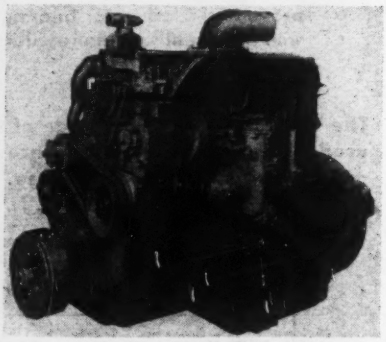
High Speed Diesels

Higher speed and horsepower than in former engines characterize the recently announced Series NH-600 and NHS-600 Cummins diesels. Operating speed is increased to 2,100 rpm.; bore and stroke



5⅛ x 6 in. increases piston displacement to 743 cu. in.; dual intake valves provide greater air supply and rapid exhaust of gases.

A high percentage of parts can be used interchangeably in either series, and they employ the four-stroke principle of operation.—*Cummins Engine Co., Inc., Columbus, Ind.*

• • •

Vacuum Pump

Designed to provide a high degree of vacuum and a sufficient volume of air to instantly remove liquid residue from wood and metal containers, a new vacuum pump is automatically lubricated and has a relief valve to regulate the degree of vacuum used.

The outfit, mounted as an electrically-powered mobile unit, or with a gasoline engine, is complete with rubber hose and special suction tool. Liquid residue is caught in the tank; a glass gage shows the quantity, which may be drained off by a drain plug.—*Leiman Bros., 115-79 Christie St., Newark 5, N. J.*

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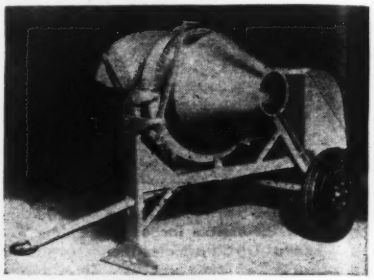
Air-Cooled Concrete Mixer

A recently announced ½-bag tilting mixer is equipped with an air-cooled engine, high tension magnets and simple rope starter. Power is transmitted



to the drum drive shaft by a roller chain which runs at low speed on machine-cut sprockets.

The house has a hinged cover, opening like an auto trunk. Every part of the engine is said to be easily accessible.—*T. L. Smith Co., 2835 North 32nd St., Milwaukee, Wis.*

• • •

Wire Stripper

Many types of light insulation, and round, flat or rectangular wire, solid or stranded, may be economically stripped with a new two-brush wire stripper, the manufacturer states. The two brushes are mounted directly on the end of separate motor shafts; the right hand motor, mounted on a pivoted base and normally held up by a spring, keeps the brushes apart when not in use.

The brushes are made in sections, of special steel wire ground to size; each section is replaceable. Strippings and dirt are removed by a dust collector, driven by a separate motor.—*Ideal Commutator Dresser Co., 1368 Park Ave., Sycamore, Ill.*

• • •

All-Purpose Conveyor

Available in 13 ft. 9 in. or 20 ft. lengths, the new Tote-All is a lightweight, portable endless belt type conveyor. Either model may be driven by an electric motor or a gasoline engine. The conveyor comes equipped with a 1½ or 2.3 hp. engine, or it may be had

The Massengill Monument, Johnson City, Tennessee, erected in memory of a pioneer East Tennessee family.

Progressive Johnson City, Tennessee,

Finds DROTT Bullclam Shovel Method of Sanitary Fill Shortens Haul, Saves Trucks, Repairs and Tires

An industrious city of 30,000 population, Johnson City, Tennessee, is another modern community that finds it pays in every way to use the Drott Bullclam Shovel Method of Sanitary Fill.

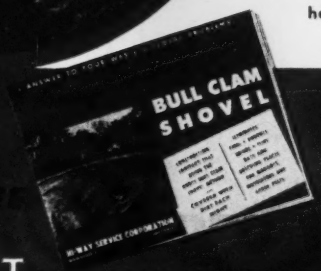
"Not only do we eliminate an unsightly, unsanitary dump, but we are also showing a definite saving in our truck miles, repairs and tires," says M. U. Snoderly, City Manager.

You are cordially invited to inspect the Sanitary Fill at Johnson City. In the meantime, write for all the facts. Make sure your community benefits from this new type, money-saving method of refuse disposal.

OLD CITY DUMP previously used. Located 3½ miles from center of town. Unsightly areas like this are needed for Johnson City.

NEW SANITARY FILL 1¼ miles from center of town — being constructed with a Model 60 Drott Bullclam Shovel. Note neatness of fill. Refuse is completely covered every night.

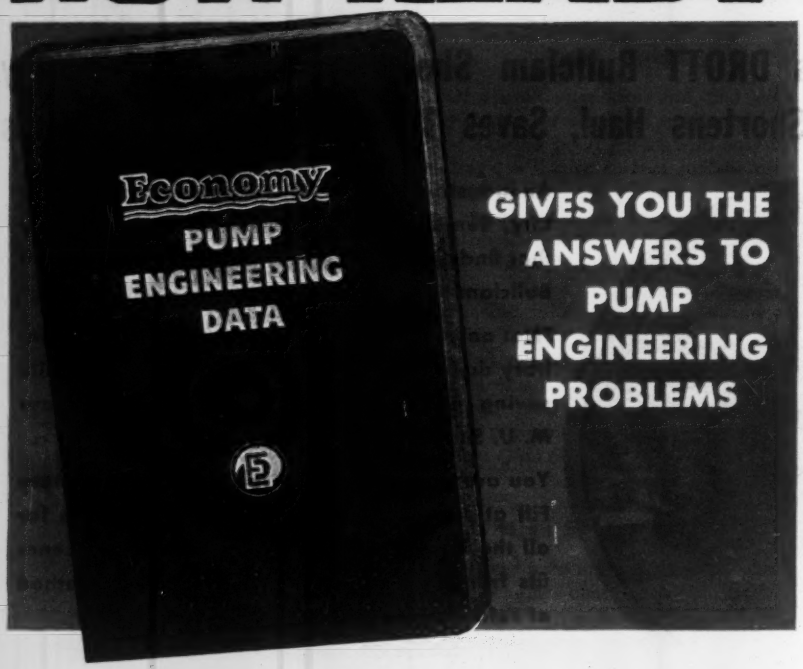
4-F man doing an A-1 job. Mr. J. B. Curl, in charge of garbage and rubbish collections, skillfully operates Johnson City's Drott Bullclam Shovel even though he is handicapped, having only one arm. Note new trench being dug.



DROTT EQUIPMENT

HI-WAY SERVICE CORPORATION

NOW READY



A timely contribution to the pump industry—416 pages of factual data just when vital postwar problems require authentic facts, sound experience and advanced engineering practice.

Here, under one cover, are hundreds of handy tables and diagrams you need every day. Revised, improved and new data governing the correct layout and installation of sewage, drainage, processing, heating systems, etc. Describes clearly and exactly the way to do the job right.

Indispensable to Executives, Engineers, Plant Managers, Maintenance Men, etc. Sent free in response to requests on business letterheads.

If your copy is delayed in reaching you, we're sorry, and ask your indulgence. The unprecedented demand temporarily exceeded the manpower for handling—but all requests received to date are being filled in rotation.

ECONOMY PUMPS, INC.

HAMILTON, OHIO • U. S. A.

FOR OVER THIRTY YEARS MAKING BETTER PUMPS DO MORE

TRACK HAULAGE IS CHEAPER HAULAGE

PLYMOUTH LOCOMOTIVES

• FROM 2½ TO 70 TONS •

PLYMOUTH LOCOMOTIVE WORKS

Division of The Fate-Root-Heath Co., PLYMOUTH, OHIO, U. S. A.

without a power unit.

The models are available with standard or high engine mounting; the mounting is adjustable to keep the engine level regardless of the angle of the conveyor.—*Coaltoter Conveyor Co. (Tote-All Division), 310 South Michigan Ave., Chicago 4, Ill.*

• • •

Grouting and Patching Aid

Valuable in concrete grouting and patching, repointing mortar joints and sealing precast pipe joints, a new compound, Ferrolith "G", permits operation of machinery and use of bolts 12 to 24 hours after grouting.

It is said that this material, when mixed with cement and applied as a grout, expands upon oxidation and overcomes concrete shrinkage. This compound thus eliminates vibration and shifting of machinery, provides a secure anchorage for bolts and strengthens structural and other supporting columns.—*L. Sonneborn Sons, Inc., Building Products Division, 88 Lexington Avenue, New York 16, N. Y.*

• • •

Flame-Proof Paint

Ready-mixed for use, a new flame-proof paint, Blaze-Pruf Silver-Lume, may be applied by brush or spray without thinning over hot or cold surfacing. This material will stand up to 1,800 deg. F heat and is said to be non-burnable.

Because of its rust-preventive features, this paint is valuable in penetrating rusted pits and pinholes and sealing against corrosive action.—*The Wilbur & Williams Co., Park Square Bldg., Boston 16, Mass.*

• • •

High-Capacity Scale

High gross, weighing capacity is combined with accurate fractional weight readings in the Kron unit weight cabinet scale. The capacity can easily and precisely be increased as much as nine times for heavy-duty service, according to the announcement.

By rotating a handle, 1 to 7 unit weight increments can be added; these increments are shown in a target on the dial chart as they are added to the lever system. Flexible cables allow the dial head to swivel to any desired position.—*The Yale & Towne Mfg. Co., Philadelphia Division, Philadelphia 24, Pa.*

• • •

Luminous Indirect Lighting

Designed for drafting rooms, offices, etc., a new luminous, indirect luminaire, known as the Guth Cadet, may be suspended 24 to 30 in. below a ceiling in

individual or end-to-end arrangement. Translucent cream-white deflectors deliver light in the ratio of 90 percent upward and 10 percent downward.

The Cadet lighting system provides vertical illumination simulating that of the horizontal; this insures easy reading on inclined as well as flat planes. The fixture is made in 48, 60 and 96-in. lengths, for 40 and 100-watt and 40-watt F. lamps respectively.—*The Edwin F. Guth Co., 2621 Washington Ave., St. Louis 3, Mo.*

• • •

Mobile Crane

Self-propelled and one-man operated, a new crane is powered by a single gasoline or diesel engine, and is equipped with an all-purpose, jib-extension boom for multiple yard operations. The

crane's rated lifting capacity is 5 to 7 tons from the 30-ft. straight lattice boom; the 8-ft. jib extension, which will handle 4,000 lb., is designed for close-in operations. Each cargo hook works independently. The full-vision cab is said to afford the operator an unobstructed view at all times.—*Unit Crane & Shovel Corp., Milwaukee 14, Wis.*

• • •

Plastic Coater

Of great use in protecting precision cutting tools and gauges in storage or during shipment, two new small models of a plastic coater tank have all the features of larger units. A plastic pump arrangement keeps a constant level in the dip tank and continuously removes surface film and bubbles. In addition, oil jackets the sides and bottom of each tank. Oil and plastic are thermostatically controlled.—*Youngstown Miller Co., Sandusky, Ohio.*

• • •

Round Face Stamps

Particularly suitable for marking aluminum and magnesium alloy parts

During more than a quarter-century of *continuous* production of "*air-cooled power*," Briggs & Stratton has been constantly recognized as the leaders in this field—and has earned foremost recognition for pioneering in improved design—for engineering advancements—and for constantly improved precision manufacture.

Their unequalled performance has again been proven by the brilliant record of Briggs & Stratton 4-cycle *air-cooled* gasoline engines in hundreds of standard and special wartime uses and applications. Their dependable service under severest conditions assure still greater service in the period ahead—through use on an ever increasing number of gasoline-powered appliances and equipment.

Air-Cooled Power 4 CYCLE BRIGGS & STRATTON GASOLINE ENGINES

Only in Briggs & Stratton 4-cycle air-cooled gasoline engines can you get the extra performance, the durability, and economy made possible *through 25 years of consistent leadership.* Let us help you plan in fitting this dependable power into your designing and production of gasoline powered equipment, tools, and appliances.

BRIGGS & STRATTON CORP., Milwaukee 1, Wis., U. S. A.

USE THE PIPE THAT NEVER WEARS OUT

All of the ancient civilizations — Persian, Egyptian, Grecian, Roman—used Clay Pipe and many of these sewers and drains have been uncovered intact in recent years.

Modern times, too, are replete with examples proving that *Clay Pipe never wears out!* For example, a Clay Pipe sewer installed in Washington, D. C., over a century ago was unharmed when uncovered.

Clay Pipe is ageless because it is chemical-proof and abrasion-proof . . . is impervious to acids, alkalies, industrial wastes, gases and the grinding abrasion of sand and gravel . . . it does not corrode, decompose or crumble.

Use Clay Pipe for sewers and drains in building highways, streets, airports, railroads, public buildings, factories and homes, because when you consider ultimate cost, you'll agree it will pay to use clay.

Write for information to National Clay Pipe Manufacturers, Inc., 111 W. Washington Street, Chicago 2, Illinois.

C-1244-22

SPECIFY CLAY PIPE

subject to tensile or torsional stresses, a new line of hand stamps features roundface characters, to lessen crack formation. A complete assortment of round-face figures and letters is available; all characters are designed in accordance with S.A.E. aeronautical specifications.

Plain or knurled shanks are provided and each stamp is tempered by automatically controlled heat treating methods. Tapered and rounded heads retard peening and chipping.—*New Method Steel Stamps, Inc.*, 147 *Jos. Campau, Detroit 7, Mich.*

• • •

Illuminated Magnifier

Designed to simplify and speed up visual inspection operations in the drafting room, the new Magni-Ray Model C illuminated magnifier has a 5-in. lens of high-grade optical glass. It is encased in an aluminum alloy casting.

The magnifier is equipped with two 4-in., 25-watt tubular bulbs specially silvered so that the light is reflected directly on the work; it uses 110 volt current, AC or DC. The base is covered with a deep green backing. The magnifying device is supported by a triangular 12x12x12 in. cast iron base. —*George Scherr Co., Inc.*, 200 *Lafayette St., New York* 12, *N. Y.*

• • •

Gas Pipeline Computer

Using Weymouth's Formula or the General Pipeline Formula, a new gas pipe-line computer is said to give "all the answers" in, respectively, three and five steps. This device will determine: rate of flow from known length, size of pipe, inlet and outlet gage pressure; equivalent pipe lengths and diameters; capacity of a looped system; friction factor; efficiency of an operating line.

This computer, designed after considerable study, is 7½ in. diameter. A booklet of directions is included.—*Willsonn Computers*, 925 *Central Avenue Extension, Oil City, Pa.*

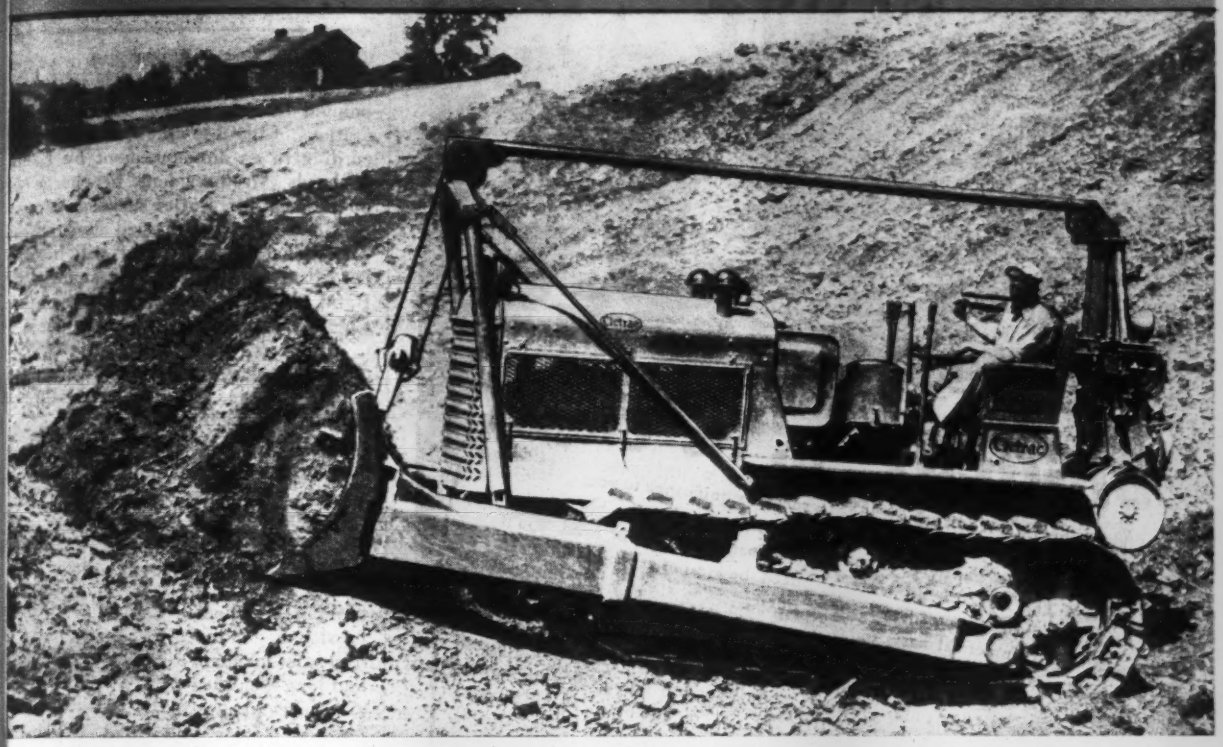
• • •

Rust Solvent

Although it has an affinity for rust itself, a new rust solvent, Carbō-Rustex. will not attack unoxidized metal, the manufacturer states. Many chemicals go into its composition, each of which reacts individually upon various rust conditions.

Carbo-Rustex is non-toxic, non-injurious to the skin and non-inflammable. Applied by brush, spray or dip, it spreads readily and leaves no globules. —*Carbozite Corp., First National Bank Bldg., Pittsburgh 22, Pa.*

THEY NEVER LOSE THEIR GRIP!



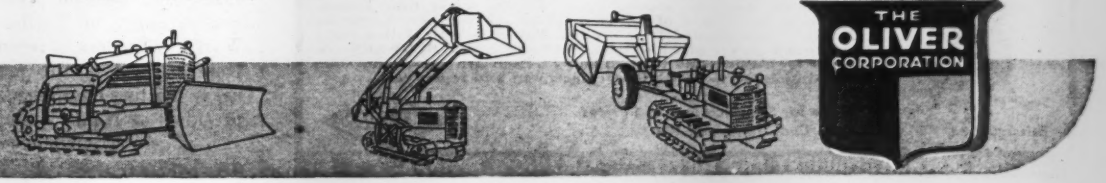
• Hard or muddy ground... turns or straightaway ... downhill or up, Oliver "Cletrac" crawler tractors never lose their sure-footed grip on the ground. For only Oliver "Cletracs" have *controlled differential steering* . . . the patented principle that keeps power on both tracks at all times.

You simply slow down one track and speed up the other to get a short, sharp turn. This feature alone assures greater safety on hills and slopes, for there is always traction on both tracks. They steer the same going downhill with a load as up. There is no need for the operator to cross-over on the controls as is necessary on the ordinary tractor.

Oliver "Cletrac" tractors are designed for tough, hard service. Lubrication and maintenance are simple, for these tractors are unusually accessible. They are ruggedly built to resist the twists and strains of tractor service.

Substantial numbers of Oliver "Cletracs" are now being released for essential service. Your Oliver "Cletrac" dealer will gladly assist you in making application for a new tractor. **The OLIVER Corporation,** Industrial Division, 19300 Euclid Avenue, Cleveland, Ohio.

OLIVER - Cletrac



BIGGEST in its Class

Like the gigantic Kodiak bear, biggest carnivorous beast in existence, the newest Fuller transmission tops its class. The 5A920 is the largest, huskiest automotive transmission sold on a commercial basis today. It is generally acknowledged to be the only available automotive transmission capable of handling some of the big new engines recently put into off-highway and other extra-tough service. That it is handling them in highly satisfactory fashion is a demonstrated fact.

There are two reasons why this super-transmission should be of special significance to you:

First, if you've got a big job "on the board" or in your head, you'll need the kind of capacity Fuller can offer.

Second, even if you don't need bull strength, you still want a transmission made by the people who know how to meet demands for ruggedness, compactness and easy shifting.

Whatever your needs, don't overlook the Fuller Transmission of Tomorrow. If you're planning something now—then now's the time to get in touch with us.

FULLER MANUFACTURING COMPANY, KALAMAZOO 13F, MICHIGAN
Transmission Division
Unit Drop Forge Division, Milwaukee 1, Wisconsin

BOILERS "SNAP OUT OF IT!"

MARION SOOT BLOWERS

modernize boilers right now! They do this work:

- Increase boiler capacity and flexibility
- Save 5 to 10 percent on fuel bills
- Do the job mechanically and quickly
- Blow out soot deposits without injury to baffles

MARION SOOT BLOWERS eliminate stubborn soot with minimum waste of steam. Type "F" for water tube boilers blows in any length of arc from 15 to 345 degrees. "Keeps on Rollin' " to right or left as desired. Favorites with skilled engineers and power plant owners, MARION SOOT BLOWERS are made for all sizes and types of boilers. Parts are interchangeable. Continuous service with low replacement and repair costs.

Type "F" Automatic Valve, Balanced Head

Write for Specifications and Prices
Save Coal, Time, and Worry

THE MARION LINE

MARION MACHINE, FOUNDRY AND SUPPLY CO. • MARION, INDIANA, U. S. A.

Manufacturers' Activities

CHARLES P. CUTLER has been appointed district manager of Chicago operations of the Republic Steel Corp., according to an announcement by E. M. Richards, vice-president in charge of operations. Mr. Cutler succeeds Mowry E. Goetz, who was named assistant to Mr. Richards. Mr. Cutler will be succeeded as assistant district manager by P. M. Murphy, superintendent of the Chicago wire mills of the company.

SEVERAL new appointments to key positions in the Allis-Chalmers tractor division sales organization have been announced by W. A. Roberts, vice president of the company and manager of the tractor division.

M. L. Noel

Marshall L. Noel, previously industrial sales manager and long identified with the company's crawler tractor and road machinery sales, is appointed general sales manager of the division.

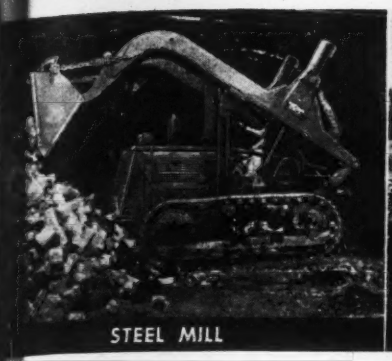
William J. Faulkner, formerly manager of the tractor division's Washington, D.C., office, becomes industrial sales manager. Assistant industrial sales managers are F. B. Harrison, formerly territory sales manager, and E. G. Kullmann.

Louis Adams has been appointed Harvester line sales manager. S. H. Sorenson will be assistant Harvester line sales manager.

Ernest Franks has been placed in charge of wheel tractor sales for industrial purposes, in addition to his former duties as manager of power unit sales.

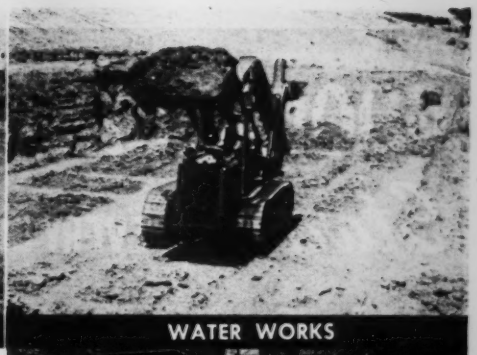
Boyd S. Oberlink, until recently an assistant industrial sales manager, is appointed assistant to the vice-president, tractor division.

O. A. TUCKER, former vice president and general manager of the Tacoma, Wash., division of Todd Pacific Shipyards, Inc., became president and general manager of Pacific Iron & Steel Works, Tacoma, recently. Pacific Iron & Steel is the manufacturer of heavy hoisting equipment. R. J. Lamont, president of Todd Pacific, now is acting also as general manager of the Tacoma division.



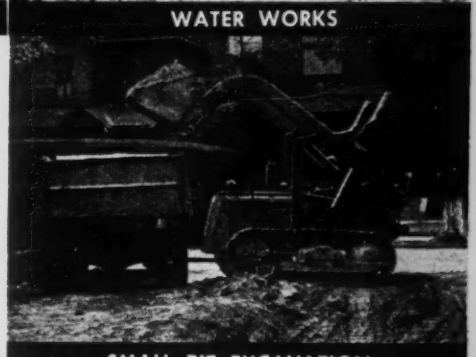
STEEL MILL

BUILDING EXCAVATION

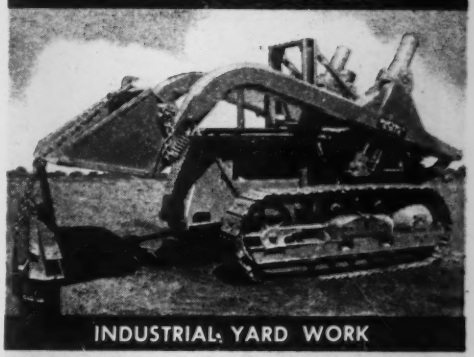


WATER WORKS

its speedy, versatile performance: full front visibility, low overhead clearance, oscillating tracks, positive down pressure, simple rugged design, "even keel" balance, quick easy interchangeability. If your work involves handling sand, gravel, dirt, coal, rock, snow, ice, or any other bulk material, it will pay you to take advantage of the consistently economical performance you can get with a Dozershovel. See your International TracTracTor Distributor for complete details on Dozershovels for T6, TD6, T9, and TD9 TracTracTors. 10T45C



SMALL PIT EXCAVATION



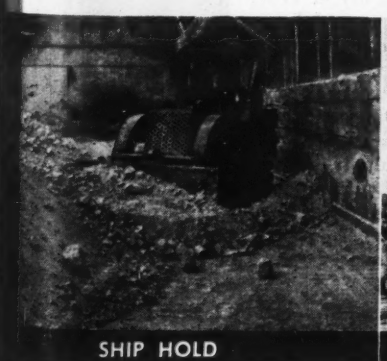
INDUSTRIAL YARD WORK

BUCYRUS ERIE

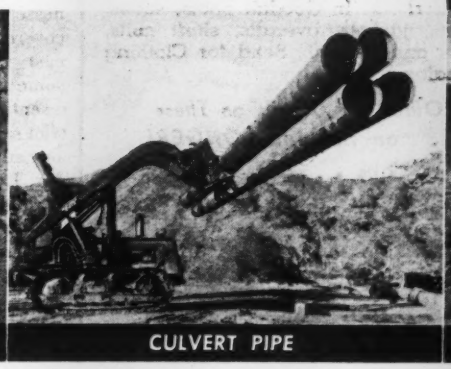
SOUTH MILWAUKEE, WISCONSIN

SEE YOUR INTERNATIONAL TRACTRACTOR DISTRIBUTOR

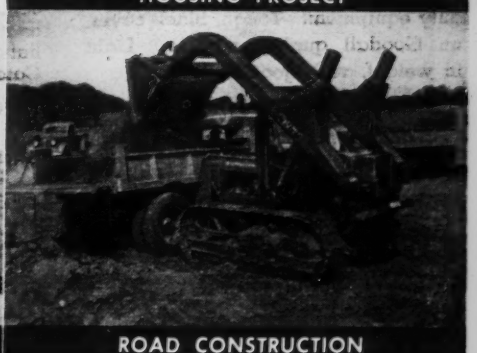
HOUSING PROJECT



SHIP HOLD



CULVERT PIPE



ROAD CONSTRUCTION

GOODALL *Assures a Head Start...* ON EVERY CONSTRUCTION JOB!

AIR HOSE

Made to quality specifications in both moulded-and-braided and wrapped duck constructions, for all light and heavy duty pneumatic tool service. "Subway," "Mine King" and "Oil King" are well-known brands in the line. Some are all-Synplastic.

WATER HOSE

"Roadbuilders" has an unequalled reputation for long-life performance on pavers, mixers and other heavy-duty equipment. Tough, black cover, on Goodall quality carcass. Light in weight, with good flexibility.

STEAM HOSE

Goodall Steam Hose is built to assure safe, reliable service on pile driving and all other steam jobs, at maximum working pressures and temperatures. "Inferno," "Judson" and "76" are familiar to construction, road-building and mining men because of the many years through which they have established the standards for steam hose quality.

★ ★ ★

GOODALL BOOTS and CLOTHING

There's adequate protection . . . *plus comfort* . . . in Goodall boots, shoes, coats, jackets, overalls, shaft suits, hats and gloves. Send for Clothing Catalog.

Contact Our Nearest Branch or Main Office for Details on These and Other Products by **GOODALL . . . *on the Job LONGER!***

GOODALL RUBBER COMPANY

THE GOODALL-WHITEHEAD COMPANIES

Philadelphia • Trenton • New York • Chicago
Pittsburgh • Boston • Los Angeles • San Francisco • Seattle
Salt Lake City • Houston

Factory—Trenton, N. J.

Established 1870

FRED W. DEUTSCH is now associated with Builders-Providence, Inc., Providence, R. I., as assistant sales manager. He will be concerned with sale of water and sewage works equipment and also recording, indicating and controlling instruments for industrial applications.

Mr. Deutsch attended Stevens Institute and has been active in the municipal and industrial equipment fields. For several years he was connected with the Permutit Co. and later with the Duro Pump Co. In 1940 he joined the Everson Manufacturing Co. becoming vice-president in 1943 and continuing in that office until early this year.

ASSOCIATION of the Van Devanter Engineering Co. of St. Louis, Mo., as sales representatives is announced by Yeomans Brothers Co., Chicago, manufacturer of pumps, compressors, and sewage treatment equipment. The St. Louis firm will handle sales and service in eastern Missouri and southern Illinois. H. L. Grossman Co., St. Louis, will continue to represent Yeomans in the building and industrial fields in much of the same territory.

M. S. Van Devanter, founder of the firm, is also president of Russell and Co., Inc. which erects, maintains and operates sewage treatment plants and other sanitary facilities for municipalities. He spent seven years with the Missouri State Highway department, handling various types of construction, before he returned to private consulting work and specialized in sewage and water treatment.

JACK C. LYLE, has joined the Ludlow Valve Manufacturing Co., Inc., Troy, N. Y., to take charge of its southern territory.

Mr. Lyle is a graduate of the University of Tennessee, and has covered the southeast territory for some years as representative and district sales manager for supply houses and manufacturers. Mr. Lyle will make his headquarters at Atlanta, to cover Georgia, Alabama, western North Carolina, South Carolina, eastern Tennessee and Florida.

FORMATION of the Flexicore Co., Inc., 220 East 42nd St., New York City, to handle production and merchandising

U.S. Signal Corps photo showing McKiernan-Terry 9B3 Hammers being used on pile driving operations on the Wesel bridge across the Rhine.

When the most advanced front line troop detachments land on beachheads, capture ports or cross rivers in this global War, the first work to be done is to construct or reconstruct these facilities.

Large numbers of McKiernan-Terry Pile Hammers have been used in this work which is of gravest importance. In every theatre of the War they have been essential equipment for U. S. Engineers, Navy Department and Seabees.

Two essential requirements have had to be met in these vital tasks: *PERFECT PERFORMANCE* under the most arduous conditions, and *PROMPT DELIVERIES* under the most exacting schedules.

The large, modern, well-equipped McKiernan-Terry plants at Dover and Harrison, N. J., have produced the required hammers in ever-increasing quantities. The dependability of these machines has been thoroughly demonstrated in every war-time task to which they have been assigned, as well as in hundreds of important prewar projects all over the world.

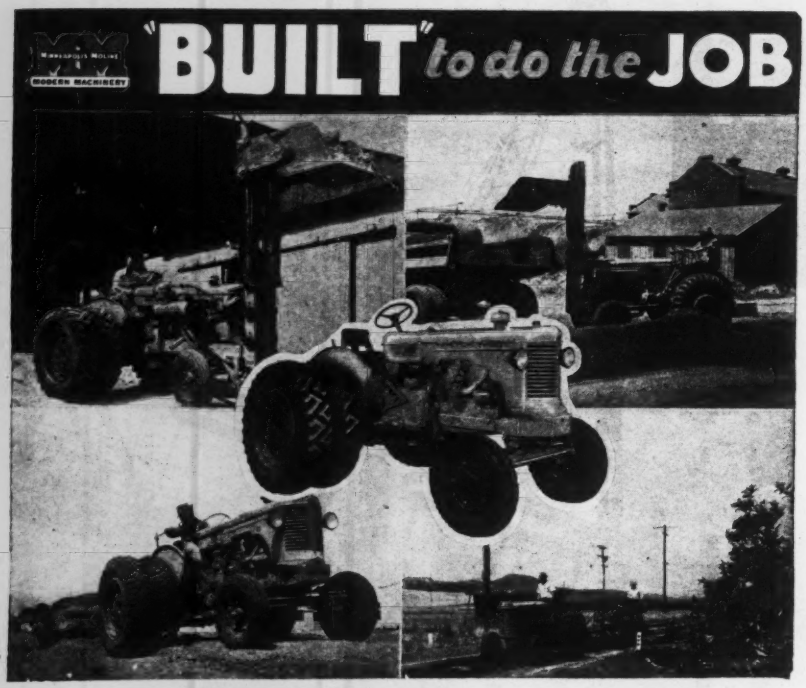
The same manufacturing facilities and designs that have enabled McKiernan-Terry Pile Hammers to make these records will be available after the War to produce the best, not only in Pile Hammers, but in other products as well . . . Marine Equipment, Hoisting Equipment and Special Machinery, of which much has been and is being furnished to the Navy Department and Maritime Commission during the War. These facilities will help speed peacetime construction jobs and other activities in the Marine Field.

McKiernan-Terry
9B3 Double-Acting Pile Hammer

For Final Victory
Buy MORE War Bonds

McKiernan-Terry CORPORATION

13 PARK ROW NEW YORK 7, N. Y.



It's **PERFORMANCE** *that Counts...*

"Know-How" are small words but they have a ***big meaning*** in the manufacture of ***industrial tractors.*** "Know-How" and "Built to do the Job" are synonymous in building ***MM Industrial Tractors.*** The dependability, durability and low operating cost of MM Industrial Tractors is widely known. MM Industrial Tractors are built not only to pull graders, scrapers, packers and tampers but are also versatile enough to be adapted to loaders, cranes, snowplows and bulldozers. The short turning radius, good traction, high road speed, heavy-duty engines, special heavy-duty front axles, steering gears and counter weights make them ideal to "fit in" on the hundreds of jobs in any road or highway program. MM Industrial Tractors have a power range of from 27 to 64 brake HP on 70 octane gasoline and are built for ***real power without sacrificing*** operating economy and long life performance.

MODEL	ENGINE	BRAKE HP ON 70 OCTANE GASOLINE	FORWARD SPEEDS	MILES PER HOUR
RTI	3⅜ x 4-4 cyl.	27	4	2 to 11
UTI	4¼ x 5-4 cyl.	48	5	2.2 to 18
GTA-I	4⅜ x 6-4 cyl.	64	4	2.5 to 10

MINNEAPOLIS-MOLINE POWER IMPLEMENT COMPANY
MINNEAPOLIS 1, MINNESOTA, U. S. A.

of a new precast concrete floor and roof slab, originally developed by Price Brothers Co., of Dayton, Ohio, has been announced by March M. Harrison, executive vice-president. Roger H. and Louis P. Corbetta of the Corbetta Construction Co. are president and secretary, respectively, of the Flexicore Co., Inc. With more than $75,000,000 worth of construction, obtained through competitive bidding, to their credit since February, 1941, the Corbettas are qualified to enter this phase of the construction field. Mr. Harrison has had experience in domestic and foreign marketing of wall boards and related types of building materials. He has also been active in market surveying, commercial research, new product development, and industrial organization.

OLIVER IRON AND STEEL CORP. has announced the appointment of Edward M. Welty as general manager of sales of its industrial fasteners division, succeeding James G. Graham.

Mr. Welty joined the Oliver organization in Pittsburgh 34 years ago and was on the Philadelphia sales staff. He was advanced to manager of the Philadelphia office before returning to Pittsburgh. He was called to Washington in July, 1942, as chief of the Bolt and Nut, Screw and Screw Machine Products Division of the War Production Board, serving until Dec. 31, 1943, when he returned to Pittsburgh to become assistant general manager of sales of the industrial fasteners division.

THE FRUEHAUF TRAILER CO., has purchased the Trombly Truck Equipment Co., Portland, Ore. According to W. J. Jarvis, Portland branch manager of Fruehauf, this addition to the firm's facilities in the northwest is part of an expansion program planned to benefit

— LONG LIFE FOR MAGNET CABLES —

On the Rud-O-Matic Combination Magnet Reel and Tagline, both drums revolve together. In attaching the electric magnet cable, a little slack is allowed. The tagline cable is attached with sufficient tension to steady the magnet. Both cables then feed back and forth in the same relation as originally set. An inner spring on the reel drum provides the tension. With this equipment there is no chance for the electric cable being pulled apart or jerked loose from connections.

Most Crane Manufacturers have adopted Rud-o-Matics as standard equipment

McCAFFREY-RUDDOCK TAGLINE CORPORATION
2121 EAST 25TH STREET • LOS ANGELES 11, CALIFORNIA

George lets Mack do it!...

"Let George do it!" is the answer to lots of tough hauling problems around Baltimore, Maryland. And the George Transfer and Rigging Company answers the challenge of the heaviest loads with rugged, reliable Macks. The George fleet includes sixteen hard-working Mack trucks. That selection was based on actual experience with Mack performance, dependability and stamina. Those are the qualities that are proving everywhere that you can't beat a Mack—anywhere!

***A TYPICAL GEORGE OPERATION** being handled by a Mack FJ Tractor. The load on this low-bed trailer scales a big 42 tons . . . a Main Reduction Gear manufactured by the Bartlett Hayward Division of The Koppers Company for the Victory ship S.S. Frederick. Big jobs like this are easy for Macks!*

★ BUY THAT EXTRA WAR BOND TODAY ★

Mack Trucks, Inc., Empire State Building, New York City. Factories at Allentown, Pa.; Plainfield, N. J.; New Brunswick, N. J.; Long Island City, N. Y. Factory branches and dealers in all principal cities for service and parts.

Mack

TRUCKS FOR EVERY PURPOSE

ONE TON TO FORTY-FIVE TONS

NEW Mack Trucks are available for essential civilian use. Ask for details.

DAVEY AUTO-AIR LEADS ON COMPRESSED AIR JOBS REQUIRING MOBILITY

WAR has taught America the value of mobility both on the fighting front and on the home front. The great value of self-contained units that can get to the job, do it, then get quickly on to another job is becoming fully recognized in every field. The Davey Air-Aristocrat—the famous portable compressed-air unit mounted on a trailer—has its place on day-in and day-out construction jobs.

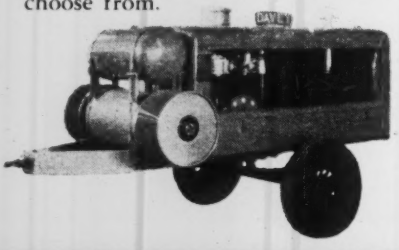
But on the short jobs, where maximum mobility means greatest efficiency, the Davey truck-mounted Auto-Air has no competition. The Davey Auto-Air is powered by the truck engine . . . through the Davey H. D. Power Take-Off . . . and is mounted behind the cab . . . uses less than one-third of the chassis space. Besides the compressor, the truck has plenty of room for men, tools and materials. The Davey Auto-Air gets to the job fast, does the job right, does the job cheaper, can do more jobs per day. It is lower in first cost and more economical to operate and maintain, because one engine runs both the truck and the compressor.

Truck-engine-driven compressors, electric welders and flood lights . . . single or combination units . . . are available. Davey Auto-Air Compressors are available in 60, 105, 160, 210 and 315 cfm capacities.

Davey Air-Aristocrats for Continuous Service

Davey portable compressors offer uninterrupted service at lower ultimate cost for the jobs that require air for days or weeks. Davey Air-Aristocrats are built for any type construction job, and for maximum efficiency in any climate.

Available in 60, 105, 160, 210 and 315 cfm capacities . . . direct driven . . . gasoline or Diesel powered . . . five mountings to choose from.



You are invited to write for a copy of the free Davey Catalog E-172, which gives full information on Davey Compressors, Truck Power Take-Offs and Pneumatic Saws, plus other pneumatic engineering data. This catalog is of special interest to engineers, builders and contractors.

D-145-6

DAVEY *Compressor Co.*
KENT · OHIO

DEALERS IN PRINCIPAL CITIES

users of trailers. The Trombly shops will operate in conjunction with Fruehauf's present Portland plant.

A PREVIEW of what the construction, excavating and materials handling fields may expect in the way of equipment is revealed in the postwar plans announcement by The Osgood Co., Marion, Ohio, manufacturer of power shovels, cranes, draglines, backhoes and kindred equipment. The company's line of power shovels, will include more than a dozen models ranging in capacity from ⅜ to 2½ cu.yd. All these rigs are well beyond the drawing board stage, with pilot models already out on test. Although several units will be improved versions of prewar products, most models embody entirely new principles of design, construction and operation.

One of the featured units is a lightweight unit of ⅜-yd. capacity. This shovel will be built of weight-saving materials, and will be crawler-mounted. A second new shovel is a 1-yd. capacity, medium weight unit embodying many features proved out during wartime construction.

HERMAN J. SCHORLE has been named works manager of the Holyoke Works of Worthington Pump and Machinery Corp. He succeeds Harry A. Feldbush, who has assumed administrative duties at the corporation's general offices in Harrison, N. J. Mr. Schorle was former executive engineer at Holyoke and assistant works manager. Assisting him is Willard A. Emery, former superintendent of all welding operations.

Worthington's Holyoke manufacturing plant produces portable and automotive air compressors, contractor's air tools, refrigeration units, air conditioning equipment, and vertical turbine pumps.

W. A. Meyer has been appointed manager of dealer sales of the Allis-Chalmers Mfg. Co., succeeding S. H. Gorham, resigned. With Allis-Chalmers since 1926, Mr. Meyer has served in the milling machinery, Texrope, and central sales departments, and was manager of general purpose equipment sales. He is vice-president and chairman of the executive committee of the Multiple V-belt Drive association.

PAUL KIRKBRIDE has been appointed plant manager of the Independence, Kan., plant of the Universal Atlas

POWERFUL *New* INGALLS SEA MULE

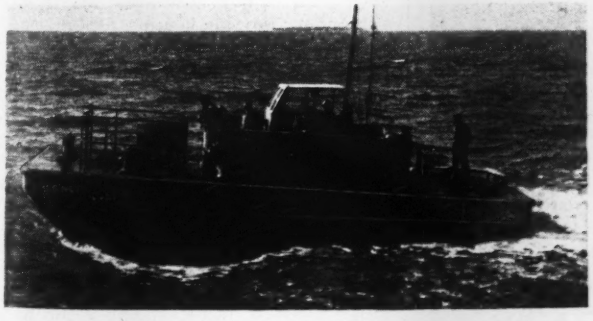
SAVES MONEY FROM THE START

The illustration shows Sea Mule Model DCQ, deep draft with crew quarters. The craft is 42 feet long, 16 feet wide. Model D, without crew quarters, is the same size and similar in design. Both types are also available in shallow draft models.

Powerful enough to do the work of a river towboat and small enough to get around easily and quickly as a harbor tug, the new revolutionary Ingalls Sea Mule costs less to buy and it costs less to operate.

Factory production of standardized designs effects economies in the initial construction and, with less bulk and weight, this powerful "floating engine" is more economical to operate, whether running free or under load. A crew of only two men can operate this all-steel marine tug efficiently.

The Sea Mule is available in four standard models—deep and shallow draft, with and without crew quarters—which allows owners and operators to select the craft best suited for their particular needs. Five types of power plants (Diesel and gasoline), ranging from 660 horsepower to 164, are available and any of the standard models can be equipped with any set of the propulsion engines. Write or phone your nearest Ingalls office for complete specifications, or to arrange a demonstration.

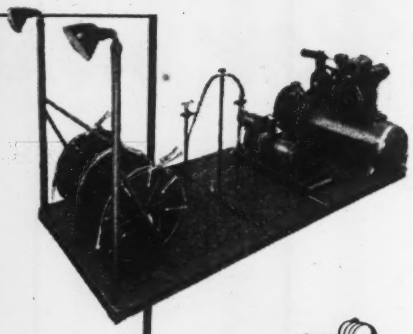


The Sea Mule has been tested thoroughly and proven in war service and this model of the Sea Mule was built by Ingalls to Navy specifications.

INGALLS INDUSTRIES

THE INGALLS IRON WORKS COMPANY, THE INGALLS SHIPBUILDING CORPORATION, The Steel Construction Company, Birmingham Tank Company. Offices at BIRMINGHAM, New York, Washington, Pittsburgh, New Orleans. Shipyards at Pascagoula, Miss., and Decatur, Ala. Fabricating plants at Birmingham and Pittsburgh.

WISCONSIN
HEAVY-DUTY
Air-Cooled
ENGINES
Help Initiate New Type of Field Service



Among the interesting pieces of special equipment developed to meet war emergency conditions . . . and which will *continue* to serve Industry . . . is the "Day and Night" portable "Lub" outfit illustrated above. This ingenious rig, combining a Wisconsin-powered direct-connected generator set and a high pressure 3-reel Lub setup (also powered by a 4-cycle Wisconsin single cylinder air-cooled engine), was supplied to the Oklahoma Ordnance Works by Harley Sales Company, for greasing and servicing "Cats" and "Bulls" on a 24-hour schedule. Powerful floodlights make night servicing as simple as daytime operations.

Just another typical application of Wisconsin Engine power to meet the needs and demands of Industry in all fields.

WISCONSIN MOTOR Corporation
MILWAUKEE 14, WISCONSIN
World's Largest Builders of Heavy Duty Air-Cooled Engines

LACLEDE **HIGHWAY STEELS**

WIRE MESH
Slab reinforcement keeps cracks closed and holds slab together.

DOWEL SPACERS
Assures correct alignment and simple installation of shear dowels.

CENTER JOINT
For controlling longitudinal cracking of pavement.

Specify Them!!

REPORTED HIGHWAY RESEARCH INDICATES STEEL REINFORCEMENT IS NECESSARY IN PAVEMENTS FOR LONG LIFE AND LOW MAINTENANCE.

LACLEDE STEEL COMPANY
ST. LOUIS, MISSOURI

Cement Co., a U. S. Steel Corp. subsidiary. He succeeds Charles M. Carman, who resigned after 25 years service. Mr. Kirkbride joined the company as engineer and assistant maintenance superintendent at the Northampton, Pa., plant in 1919. In 1924 he transferred to the Hannibal, Mo., plant as assistant general superintendent and remained there until he was assigned to Independence. He is a graduate of the Virginia Polytechnic Institute, with a degree in civil engineering. Before the first World War, in which he served as second lieutenant of Engineers, he spent six years in the engineering department of the Norfolk and Western Railroad.

CARL B. MCLAUGHLIN will head the recently established engineering service division of Tube Turns, Inc., Louisville, Ky., it has been announced by John G. Seiler, vice-president in charge of sales. The division is rapidly developing new applications for Tube-Turn welding fittings.

Mr. McLaughlin formerly was associated with Tube Turns' Pittsburgh office. A native of Jacksonville, Ill., he was graduated from the University of Illinois in 1931 and was a metallurgist engineer with the U. S. Steel Corp. before joining Tube Turns in 1943.

THE INSULATION business of the Watertown Cement Products Co., Watertown, S.D., has been sold to H. J. Parkhill & Co., a partnership composed of H. J. Parkhill and Merrill Allen. Mr. Allen is manager of the Watertown Cement Products Co. and Mr. Parkhill was formerly manager of the insulation department of that company. The change was made on account of the large increase in the insulation part of the business.

EXTRUDED METALS, INC., Grand Rapids, Mich., manufacturing extrusions of aluminum alloy for floating bridge sections for the U. S. Army Engineer Corps and extrusions for contractors supplying planes to the Army Air Corps, has announced through its vice president, R. A. Blanchard, the opening of a casting department making billets for extrusion presses and of a finishing department.

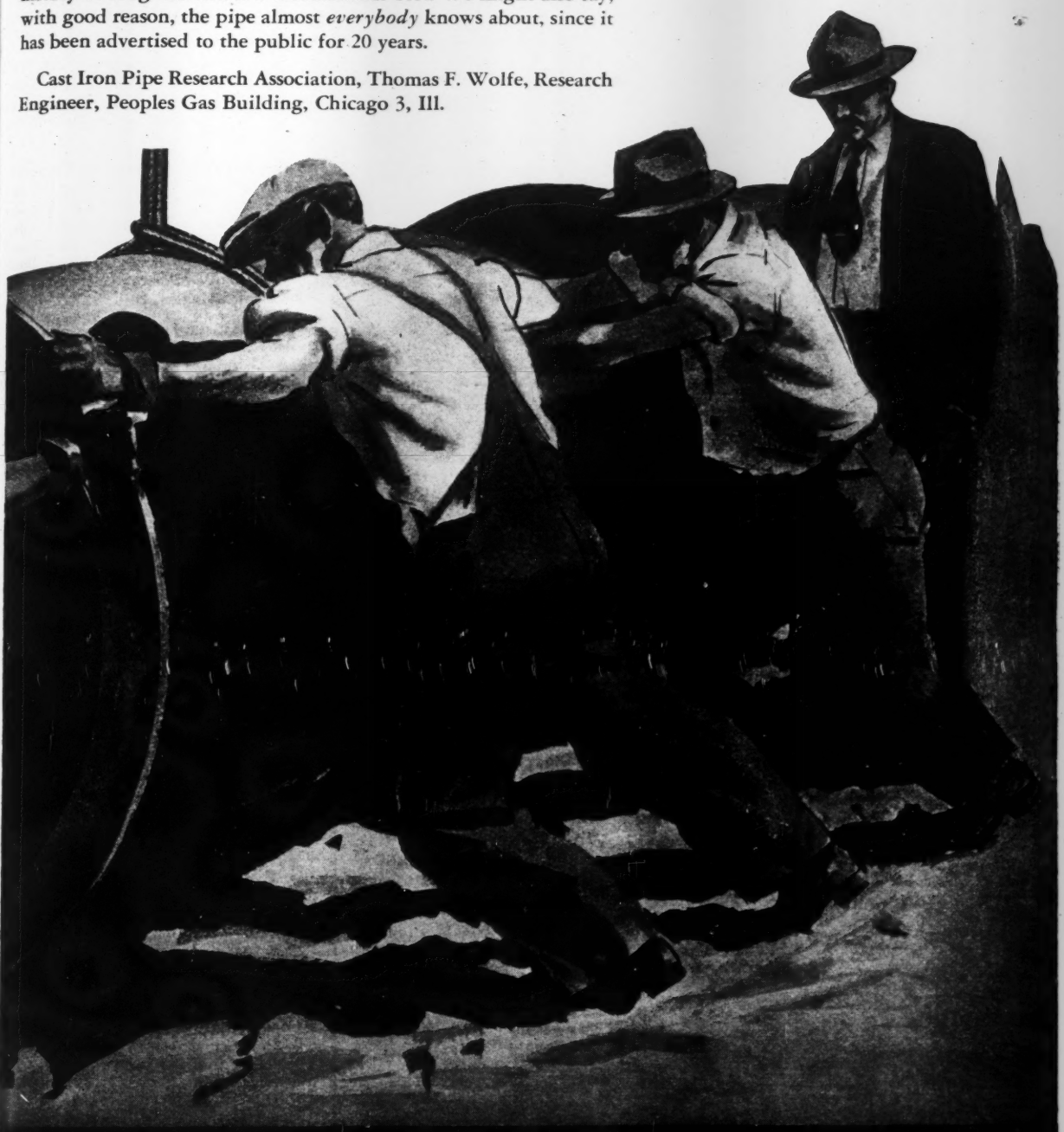
GEORGE R. FINK, president, Great Lakes Steel Corp. has appointed William H. Owen traffic manager for its N-A-X Alloy Steel and Stran-Steel divisions, and the Hanna Furnace Corporation.

You Know About

of war construction requirements. *They do not require reconversion.*

Put your trust in pipe you know about—cast iron pipe with its history of long life and low maintenance cost. We might also say, with good reason, the pipe almost *everybody* knows about, since it has been advertised to the public for 20 years.

Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, Peoples Gas Building, Chicago 3, Ill.



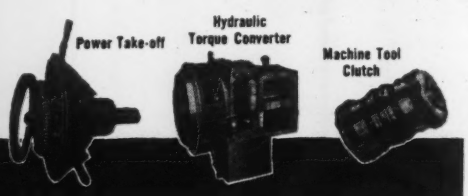
SERVES FOR CENTURIES ★ ★ ★

Hit it Easy!

The power shovel or dragline which is equipped with a Twin Disc Hydraulic Coupling is freed from excessive strains and shock loads on lines, transmission and engine. It "hits the bank easy"—crowds smoothly and steadily because shocks are not transmitted from work to engine . . . neither are the engine's torsional vibrations transmitted to the working parts of the shovel or dragline. Result: longer wear-life of the unit—less work for the operator. Why not discuss these points with our Hydraulic Division? TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).

ARMY-E-NAVY

TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES



SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918

Reports and Pamphlets

(*Continued from page* 128)

A REVIEW OF RAILWAY OPERATIONS IN 1944—Special Series No. 74. Association of American Railroads, Bureau of Railway Economics, Washington, D. C.

EFFECTS OF SOIL EROSION ON NAVIGATION IN UPPER CHESAPEAKE BAY—By L. C. Gottschalk. Reprinted from *The Geographical Review*, Vol. XXXV, No. 2, April, 1945.

STUDY OF TRANSPORTATION OF FINE SEDIMENTS BY FLOWING WATER—By A. A. Kalinske and C. H. Hsia. University of Iowa Studies in Engineering Bulletin No. 29. Iowa City, Iowa.

REPORT ON THE PHYSIOGRAPHIC, ECONOMIC, AND OTHER RELATIONSHIPS BETWEEN THE TENNESSEE AND CUMBERLAND RIVERS AND BETWEEN THEIR DRAINAGE AREAS—Message from the President of the United States to the 79th Congress. House Document No. 107, Superintendent of Documents, Washington, D. C.

EMPLOYMENT AND INCOME with special reference to the Initial Period of Reconstruction—Presented to Canadian Parliament by The Minister of Reconstruction, Ottawa, Ont., Canada.

AN UNUSUAL FOUNDATION PROBLEM, THE ALUMNI POOL BUILDING—By Donald W. Taylor. Reprinted from October, 1944, issue of the Journal of the Boston Society of Civil Engineers. Publication from the Dept. of Civil And Sanitary Engineering, Massachusetts Institute of Technology, Cambridge, Mass. Serial No. 91.

AN APPARATUS FOR MEASURING SLAB ACTION IN FLEXIBLE TYPE PAVEMENTS—By John Lowe, III. Massachusetts Institute of Technology, Cambridge, Mass. Serial No. 88.

EROSIONAL DEVELOPMENT OF STREAMS AND THEIR DRAINAGE BASINS; HYDROPHYSICAL APPROACH TO QUANTITATIVE MORPHOLOGY—By Robert E. Horton. Bulletin of the Geological Society of America, Columbia University, New York City.

PUBLIC HOUSING PAYS DIVIDENDS—Housing Authority of the City of Newark, 57 Sussex Ave., Newark 4, N. J.

PREFABRICATED HOMES—U. S. Dept. of Commerce, National Bureau of Standards. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price 5c.

SELECTED WELL LOGS IN THE VIRGINIA COASTAL PLAIN NORTH OF JAMES RIVER—By D. J. Cederstrom. Virginia Geological Survey, University, Va.

TOPOGRAPHIC MAPPING NEEDS — Recommendations for Priorities and Scales in Pennsylvania. Issued by Pennsylvania Department of Commerce, State Planning Board, Harrisburg, Pa.

AIRPORTS: Design Construction Maintenance—Reports delivered at the 42nd An-

EXIDES HAVE THE POWER AND RUGGEDNESS FOR

TODAY'S TOUGHER DIESEL CRANKING NEEDS

Working against time and heavy odds, on tough off-the-highway jobs, in all weathers and in all climates, American built automotive equipment has piled up records second only to our achievements on the battle fronts.

Thousands upon thousands of these husky bulldozers, draggers, and other Diesel-powered earth-movers are equipped with Exide Batteries designed specifically for Diesel engine cranking. They measure up fully to every requirement, for their development has kept pace, step by step, with the advances made by Diesel engineering. For dependability, long-life and ease of maintenance you can always count on Exides.

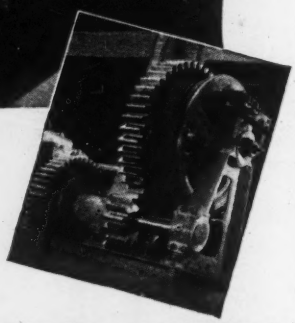
Write today for a FREE copy of the Exide Catalog on Heavy-Duty Batteries. It gives you catalog data and information on how to get the most from your Heavy-Duty Batteries.

ARMY E NAVY

Exide
BATTERIES
FOR CRANKING
DIESEL ENGINES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

Jobs



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nual Meeting, American Road Builders' Association. 1319 F St. N.W., Washington 4, D. C.

REPORT OF THE POSTWAR HIGHWAY COMMISSION—House No. 1850. The Commonwealth of Massachusetts, State House, Boston, Mass.

THE CONNECTICUT SOCIETY OF CIVIL ENGINEERS, INC.—60th Annual Report, 1944, Hartford, Conn.

ANNUAL REPORT OF THE DIRECTOR OF THE NATIONAL PARK SERVICE—Fiscal Year ended June 30, 1944, Washington, D. C.

ANNUAL REPORT OF THE COMMISSIONER OF THE BUREAU OF RECLAMATION—Fiscal Year ended June 30, 1944, Washington, D. C.

THIRTY-EIGHTH ANNUAL REPORT—Board of Road Commissioners of the County of Wayne, Detroit, Mich. Fiscal Year 1944.

FOURTEENTH BIENNIAL REPORT of the State Highway Commission of Missouri for the period ending December 31, 1944.

REPORT ON WATER SUPPLY IN FULTON COUNTY—Ohio Water Supply Board, Columbus, Ohio. Feb. 1, 1945.

REPORT ON WATER SUPPLY IN WOOD COUNTY—Ohio Water Supply Board, Columbus, Ohio. April 15, 1945.

PLANNING PAYS PROFITS, The Story of San Diego—California State Reconstruction and Reemployment Commission, Sacramento, Calif.

RIGIDITY AND AERODYNAMIC STABILITY OF SUSPENSION BRIDGES—By D. B. Steinman. Reprinted from Proceedings, April, 1945, American Society of Civil Engineers, New York 18, N. Y.

CONTROL OF INFILTRATION AND STORM FLOW IN THE OPERATION OF SEWERAGE SYSTEMS—By Ralph W. Horne. 11 Beacon St. Boston. Reprinted from *Sewerage Works Journal*, Vol. XVII, No. 2, March, 1945.

INVESTIGATION OF THE ODOR NUISANCE OCCURRING IN THE MADISON LAKES. Daniel W. Mead, Chairman, Governor's Committee, Madison, Wis.

CHEMICAL COMPOSITION OF TEXAS SURFACE WATERS, 1938-1944—By W. W. Hastings and J. H. Rowley. Texas State Board of Water Engineers, Austin, Texas.

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Manufacturers' Publications

Rust Prevention—A bulletin describes an electrical method to prevent rusting of steel water tanks, piping, and other steel structures. It illustrates the action with simple experiments, tells about the equipment, and includes a table of comparative costs, etc.—*The Johnston & Jennings Co., 864 Addison Road, Cleveland 14, Ohio.*

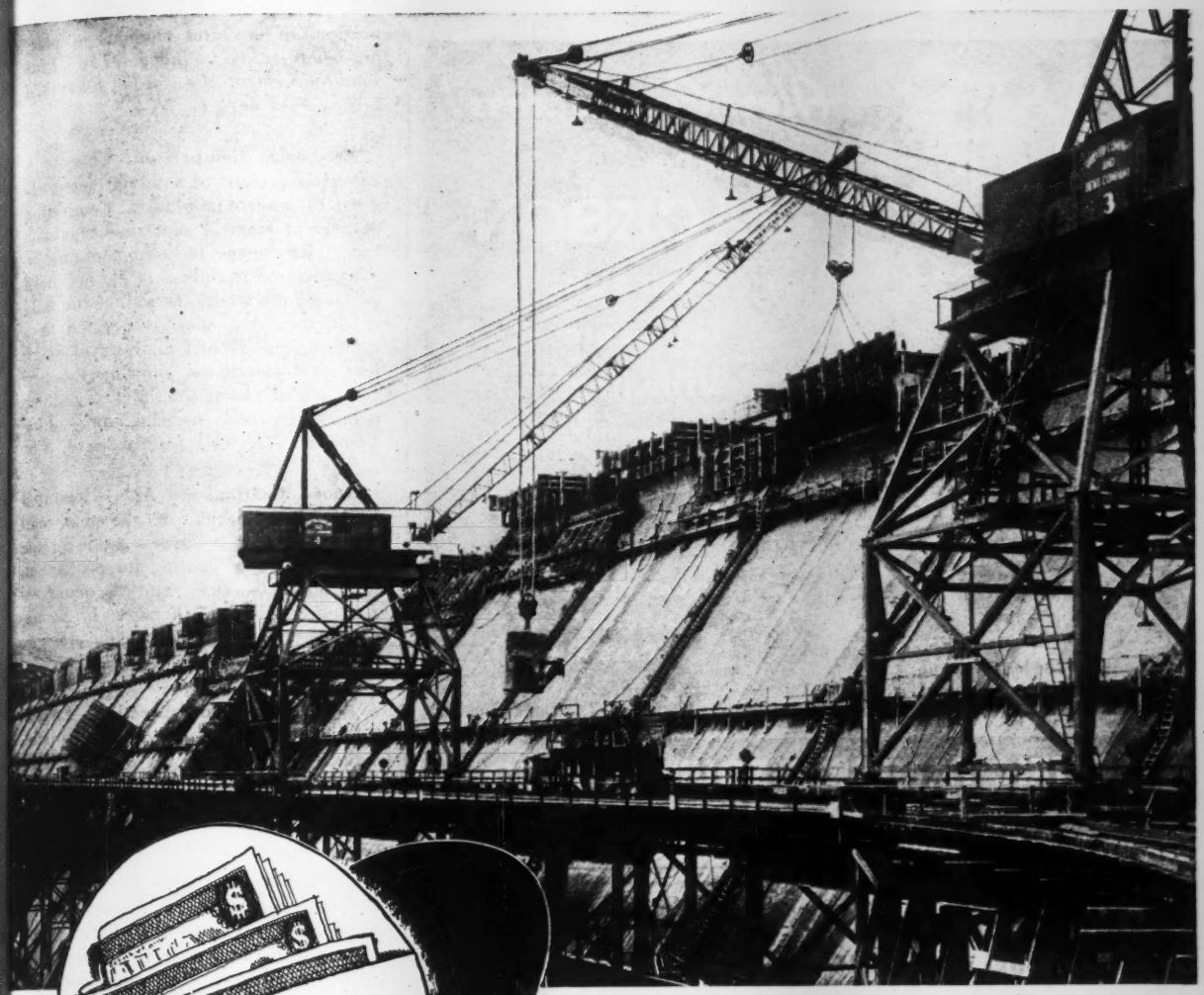
Industrial and Marine Hardware—This manufacturer of drop-forged wire rope and chain fittings has issued an indexed catalog of all available items in the line. A chart shows the fourteen vital dimensions of hoist hooks, specifying by hook number the safe load and proper size for proof coil and BBB chains, plow steel and improved plow steel wire ropes. Similar charts cover swivel hooks, turnbuckles, jaws, eyes, shackles, and closed and open wire rope sockets. Another chart gives comparative rope strength with recommended turnbuckle size and type for each size rope.—*The Thomas Laughlin Co., Portland, Me.*

Trailers—While its facilities now are devoted almost entirely to the war effort, this manufacturer has gotten out a booklet descriptive of its heavy duty trailers for the benefit of those who are looking to future requirements.—*La Crosse Trailer & Equipment Co., La Crosse, Wis.*

Construction and Industrial Machinery—Several new catalogs tell all about pumps, crane loaders, compressors, tilt and non-tilt mixers, and bituminous pavers.—*The Jaeger Machine Co., Columbus 16, Ohio.*

Timber Arch—A booklet illustrates a 200-ft. span timber arch bridge with utilization of composite timber-concrete construction in arch rib and in deck for both vertical and lateral loadings, glued laminated floor beams, concrete hinges at the spring line, and a simple crown hinge.—*The West Coast Lumbermen's Association, Seattle, Wash.*

Corrosion-Resistant Concrete—Concrete floors, drains, and machinery foundations which will resist corrosive action are described in a 16-page booklet. A question-and-answer section gives facts about the nature and use of calcium-aluminate cement and the characteristics of corrosion-resistant concrete. Information on aggregates, pro-



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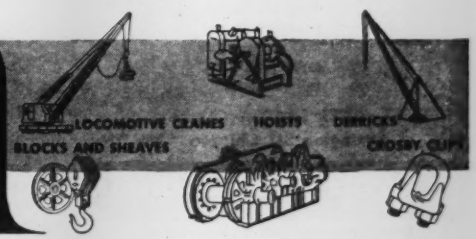

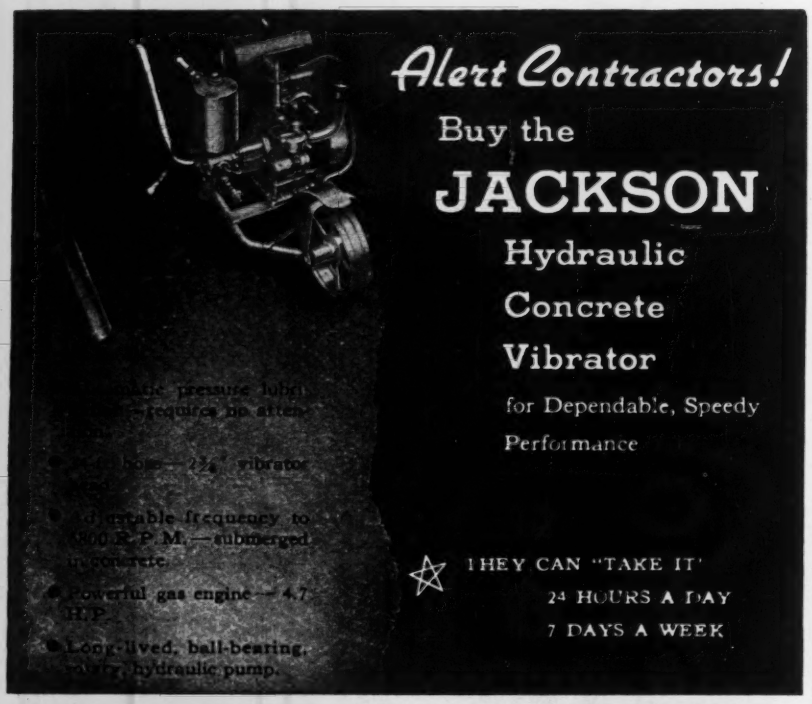

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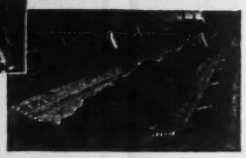

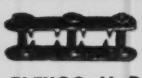

FLEXCO H D RIP PLATES are used in repairing rips and patching conveyor belts. Their use saves expensive replacements and extended shutdowns.

● Avoid shutdowns and lengthen the life of your conveyor belts and bucket elevator belts by using Flexco belt fasteners. Thousands of companies have stepped up the performance of conveyor lines and cut costs by using Flexco methods.

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portions of mix and methods of placing concrete is included.—*The Atlas Lumite Cement Co., 135 East 42d Street, New York 17, N. Y.*

Electrode Comparison Chart—A comparison chart of welding electrodes gives a complete tabulation. Comparing equipment from 22 electrode manufacturers, an 8-page bulletin contains information on stainless steel and hard surfacing electrodes, as well as the mild steel type. A section is devoted to a typical weld deposit analysis of stainless steel electrodes, showing the percentages of chromium, nickel, carbon, columbian, and molybdenum.—*Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.*

Roof Coatings — An illustrated pocket-size booklet in question and answer form is a buyer's guide in the selection of roof coating for protection, durability, service and economy.—*Building Products Division, L. Sonneborn Sons, Inc., 88 Lexington Avenue, New York 16, N. Y.*

Power for Flood Protection—Engine applications for flood protection installations are described in a bulletin by this manufacturer of gas and gasoline engines.—*Buffalo Gasolene Motor Co., 1280-90 Niagara St., Buffalo 13, N. Y.*

Steel Forms—Practical suggestions for the economical adaptation of steel forms are contained in a bulletin, which goes into detail concerning close tolerances in completed concrete construction, the advantages of obtaining smooth concrete surfaces, the ease of collapsing and stripping, the element of safety and the reduction of fire hazards, ease of inspection, the elimination of intermediate construction joints and wire ties, etc.—*Blaw-Knox Co., Blawnox, Pa.*

The Future of Welding—This company has gotten out a 46-page handbook on setting up a welding or cutting unit, and also a booklet on the welding industry in general—especially its future prospects.—*Victor Equipment Co., 844-54 Folsom St., San Francisco, Calif.*

Rolling Doors—All that anybody needs to know about steel rolling doors of every description is found in this 40-page illustrated booklet.—*The Kinnear Mfg. Co., 820-870 Fields Ave., Columbus 16, Ohio.*

Road Construction—A 24-page booklet contains descriptions of those types of road, street and airport construction in which asphalt is applied by pressure distributor trucks. It explains how to construct standard and modified types of asphalt penetration macadam paving.

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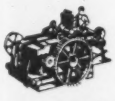

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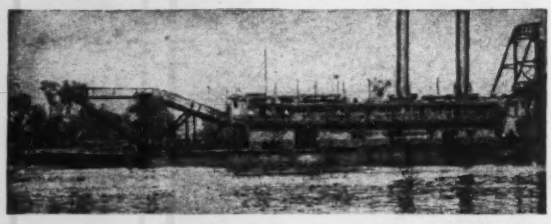

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It describes the road-mix method of building low-cost asphalt surfaces. It outlines the proper procedure for surface-treating roads with asphalt surfacing material, emulsified asphalt and asphalt cement. Useful tables for the road builder round out the booklet.—*The Texas Co, 135 E. 42d St., New York 17, N. Y.*

Floor and Roof Slabs—Advantages to be obtained with this product for postwar construction are set forth in a booklet of interest to engineers, construction contractors and others. There is a description of the product, where it is used, how installation time may be saved, how it is applied and other valuable information. The booklet likewise sets forth basic details for application in all types of buildings.—*The Flexicore Co., Inc., 220 East 42d St., New York 17, N. Y.*

Steel Grating—a catalog on open steel flooring and stair treads suggests ideas for improved design and construction. There are also charts showing how to determine exact safe loads for open steel flooring.—*Walter Bates Co., 1707 Rowell Avenue, Joliet, Ill.*

Rust Prevention— A folder gives information on the cathodic method of protection of under-water metal surfaces against rusting.—*Electro Rust-proofing Corp., Dayton 10, Ohio.*

Motorized Speed Reducers—A 52-page catalog describes a line of self-contained motorized speed reducing units, built in a variety of sizes and ratios, in both horizontal and vertical types. Complete engineering data are given.—*Philadelphia Gear Works, Erie Ave. & G. St., Philadelphia, Pa.*

Underground Pipe—A bulletin tells about a strong conduit that is said to keep underground insulation dry and retain the grade of the piping permanently.—*H. W. Porter Co., Newark, N. J.*

Construction Bulletin — A picture story of the fabrication and erection of storage tanks and similar structures is contained in a bulletin which shows the production and erection facilities in action.—*Stacey Bros. Gas Construction Co., Cincinnati, Ohio.*

Doors—In a new 12-page catalog a description is given of large doors for airplane hangars, manufacturing plants, storage buildings, industrial garages and similar structures. General information, brief specifications and facts on application and performance are supplied for canopy and motorized slide doors.—*Byrne Doors, Inc., 1150 Griswold St., Detroit 26, Mich.*